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[OFFICIAL NOTICE.]

Twenty-first Annual Meeting, Western Gas Association.

OFFICE OF THE SECRETARY,
NEW ALBANY, IND., April 6, 1898.

To the Members of the Western Gas Association: The twenty-first annual meeting of the Western Gas Association will be held at Detroit, Mich., May 18, 19 and 20, 1898, and will be called to order by the President, Mr. James T. Lynn, at 9:30 A.M., Wednesday, May 18.

The Russell House has been selected as headquarters, and the sessions will be held in a suitable room contained therein. The proprietors of the Russell House have agreed to fix these rates for the Association: Room, without bath, from $3 to $3.50; with bath, from $3.50 up.

The Executive Committee has arranged for the presentation of the following papers:

"The Enrichment of Coal Gas," by Mr. George H. Harper, Altoona, Pa.

"The Use of Gas for Purposes other than Lighting," by Mr. C. W. Blodget, Brooklyn, N. Y.

"The Igniting of Gas by Static Electricity," by Mr. Bankson Taylor, St. Paul, Minn.

"Recent Developments in Texas of Interest to the Gas Man," by Mr. Thos. D. Miller, Dallas, Tex.

"Methods of Estimating the Values of Gas Liquors," by Mr. O. O. Thwing, St. Louis, Mo.

"The Prepayment Meter," by Mr. C. H. Raynor, Adrian, Mich.

"Wrinkle Department," edited by Mr. E. H. Jenkins, Buffalo, N. Y.

"Some English Correspondence upon Isolated Generators for Bench Firing," to be read by Mr. G. Treadway Thompson, New York City.

The Michigan Passenger Association, the Trunk Line, the Central Passenger Association, the Southern Passenger Association and the Western Passenger Association, from points in Eastern Committee and Trans Missouri Committee territories, have granted rates of 1½ fare for the round trip, conditional on the presentation to the Secretary of 100 certificates for indorsement. The territory covered by the above Associations includes all States east of the Missouri and Mississippi rivers, except the New England States. It is further to be noted that the reduced rate applies to the following States and Territories west of the Mississippi and Missouri rivers: Kansas, Nebraska, Colorado, Utah, Wyoming, Oklahoma, Indian Territory and Missouri.

All persons attending the meeting should purchase a first-class ticket at starting point, paying full fare for same and obtaining from the agent a certificate stating that the person whose signature appears on same has purchased, at full tariff fare, one first-class ticket to Detroit, which certificate, after it has been signed by the Secretary of the Association and a representative of the above Passenger Associations, will entitle the purchaser thereof to a one-third rate, returning home.

All persons obtaining reduced rates must apply to agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but the certificates may be obtained on request, provided the notification is made in time. Persons outside the territory covered by the Passenger Associations named above should purchase a

ticket to nearest point within said Associations' districts, and from there purchase a ticket to Detroit, obtaining a certificate entitling them to a one-third fare returning to the place from which the certificate was obtained. The Western Passenger Association for the first time has granted reduced rates, on the certificate plan, from territory east of the Missouri river and west of Chicago, Peoria and St. Louis. It is to be hoped that this will induce members in the territory named to attend the meeting, and that it will influence other gas men not members to join our Association.

Do not travel to Detroit on mileage tickets; it is just as cheap to obtain a certificate. Nearly one-fourth of those who attended our meetings the last few years used mileage books, which practice interferes in extending the territory in which reduced rates are obtainable.

All queries sent to the Secretary for the Question Box will be assigned to members for answers.

A cordial invitation is extended to members of other Associations to meet with us and to participate in the discussion of papers presented.

The Secretary will be pleased to answer any communication pertaining to the meeting, and will mail applications to those who desire to become members of the Association. JAMES W. DUNBAR, Sec.

[OFFICIAL NOTICE.]

Wrinkle Department, Pacific Coast Gas Association.

MERCED, CAL., March 11, 1898.

To the Members of the Pacific Coast Gas Association: At the last meeting of the Pacific Coast Gas Association to me was delegated the duty of collecting and presenting any matter, in the shape of original ideas or special devices, which may come under the head of "Wrinkles," to be presented in proper form for the benefit of the Association at the next regular assembly.

Many of our members having charge of gas plants on the Coast have many plans, that are practical, handy and labor-saving, which many others by force of circumstances have never seen, but who, on presentation of the device, drawn and described, or through the medium of our official organ (the AMERICAN GAS LIGHT JOURNAL), would gladly embrace the opportunity, and put into practice a plan very beneficial—which perhaps had been in use in some obscure place many years, used exclusively by one man—that would, when given daylight, benefit the whole gas fraternity.

On reading this communication, please see if you have not forgotten something in the shape of a "Wrinkle," that is doing good service in your works, that would be of great importance to the Association. Your answer to this will greatly oblige.

GEORGE H. HOLLIDGE,
Editor "Wrinkle" Department.

BRIEFLY TOLD.

AN INJUNCTION REPORT.—An echo of the legal warfare, over the proprietary interests concerned in determining the ownership of the right to market in the United States incandescent gas lamps of the improved Welsbach type, comes to us in the shape of a recent decision, arrived at by Judge Lacombe, in the United States Circuit Court, Southern District of New York. As the matter is of peculiar interest, since it is the initial injunction sought for under the broad ruling of Judge Townsend's mandate (the Welsbach Light Company vs. the Sunlight Incandescent Gas Lamp Company, JOURNAL, April 4, 1898, p. 540), we here reproduce Judge Lacombe's findings:

"This is a suit to prevent infringement of the first claim of United States Patent No. 407,963, dated July 30th, 1889, to Rawson, and another form-production of incandescent mantles. This patent was before Judge Townsend, and the claim sustained in the recent suit in this Court of the same complainant against the Sunlight Company. It was held that the invention covered by the patent was a most meritorious one, that the patentees may be regarded as pioneers, that the patent should not be narrowly interpreted, but should be so construed as to cover a broad range of equivalents, and that it did cover mantles coated 'by dipping or immersing them in a solution composed chiefly of collodion, with the addition of a small percentage of castor oil.' Under familiar practice the decision will be followed here unless some peculiar circumstances are shown. No patent, no prior publication, no authority not before Judge Townsend is presented here. The proposition advanced upon the argument, that no serious defense was made in the earlier suit, finds no support in the record, in the briefs, or in the argument of counsel for the defendant in that case, a short-hand report of which has been submitted on this motion. Four affidavits (not properly verified for use in this action, but which may nevertheless be filed with the other papers) have been presented, asserting that affiants knew of the patented method prior to the patentees' application. This is what usually happens after a patent has been sustained at final hearing, and this Court is slow to accept such *ex parte* statements as sufficient to do away with the presumption arising from a decree at final hearing sustaining the patent.

"Infringement is sufficiently shown; indeed, when the patent is broadly construed, as Judge Townsend held it should be, it is hardly disputed.

"Motion granted."

The title of the case was that of the Welsbach Light Company vs. the Rex Incandescent Light Company. Mr. W. F. Brown and Mr. John R. Bennett represented the complainant, and the contention for defendant was made by Mr. Louis Hicks.

NOTES.—We regret to report the death of Mr. W. H. H. Childs, which occurred at his home, 388 Washington avenue, Brooklyn, N.Y., last Monday. Deceased, who was in his 58th year, had been for a long time prominent in the industry of working into merchantable shape the coal tar residual from gas works.——Mr. F.W. Little, of the Akron (O.) Gas Company, acting in conjunction with wide-awake associates, has secured control of the franchise for the supply of gas in the towns of Jenkintown and Cheltenham, Pa., which district includes the handsome residence divisions of Ogontz, Wyncote, Ashbourne and Melrose. The districts named offer a peculiarly inviting field for an enterprise of the sort specified, and the real wonder is that a gas works was not put in operation there long ago. The corporate name of the enterprise is the Jenkintown and Cheltenham Gas Company, and a controlling interest in its fortunes is held by Mr. Little. A suitable site for the works has been purchased, located midway of the district to be supplied, and contracts have been awarded for the construction of a 10-inch water gas plant, the equipment to include a storage holder up to a capacity of 100,000 cubic feet. It is estimated that the construction will involve an expenditure of $100,000, the plan calling for the placing of 10 miles of mains. Jenkintown and Cheltenham are located on the line of the Philadelphia and Reading Railroad, at a point 10 miles north of Philadelphia, and the territory of which the named places are the center is being rapidly developed as a residential district of the most enduring nature. The J. and C. Gas Company is sure to be a "go."——The officers chosen at the annual meeting of the Kansas City, Missouri, Gas Company were: President, M. J. Payne; Vice-Presidents, Randal Morgan and Crawford James; Secretary, R. Macmillan; Assistant Secretary, G. B. Goudy; Treasurer, Lewis Lillie; Superintendent, George S. Clarke.——Mr. John Lorenz, Superintendent of the Hamilton (Ohio) City Gas Works, writes us that the Trustees of the plant are considering the matter of enlarging the generating plant, which is of the coal gas type. New benches, together with the necessary standpipes and other fittings, are wanted.——At the organization meeting of the Directors in the Columbus (Ohio) Gas Company the following executive management was chosen: President, Irvin Butterworth; First Vice-President, B. F. Hubbard; Second Vice-President, D. E. Putnam; Secretary and Treasurer, A. P. Lathrop.

German Artificial Indigo Alarms the Indian Indigo Cultivators.

The *Scientific American* says that since the Badische Aniline and Soda Company, at Ludwigshafen on the Rhine, has placed its "pure indigo" on the market at a price which admits of competition with the natural product, the Indian indigo planters are naturally very much alarmed. It is correctly assumed in India that the process to produce artificial indigo will be quickly improved upon and cheapened, and that it will finally be possible to throw the artificial article upon the market at a cheaper price than the natural indigo can be sold at. Considering the exceedingly great value which the indigo trade is to East India, the press of that country discusses freely the new state of affairs. The *Capital*, a journal highly esteemed in India, admonishes the owners of indigo plantations not to lose courage, but to try their best to minimize the cost of production, it being more than likely that, if experienced chemists are engaged, the extraction of indigo from the plant may be increased, thus cheapening the product and improving its quality. Then a competitive war between the artificial and natural indigoes could well be carried on. From the same journal we learn that the value of indigo exported from Bengal is 4½ to 5¼ crores (1 crore = 10,000,000 rupees).

The largest part by far of East Indian indigo goes to England; Germany receives direct 32 lakhs' worth, Austria-Hungary and France about the same each; the United States of America takes 57 lakhs' worth (1 lakh = 100,000 rupees). The average amount of the two dyestuffs of indigo contained in good Kurpah indigo is 50 to 55 per cent., in the Bengal variety 70 to 75 per cent.

Novelties in Purifying Apparatus.[1]

The design of the apparatus for purifying gas, using the word in its narrower or technical signification—viz., treating the gas by contact with solid reagents—appears to be the subject of some attention in the United States, as will be evident from a perusal of our notices of gas managers' association meetings on the other side of the Atlantic. Some few months ago we gave an illustrated description of a quadruplex purifying box, with mechanical devices for admitting and removing oxide, designed by Mr. F. H. Shelton;[2] and last week we noticed another contrivance for effecting the same result, designed by Mr. H. G. Beatley.[3] Both these gentlemen appear to have been impressed by the cheapness, ease of working, and small ground space required for treating gas with liquid reagents, as compared with the cost and area occupied by a set of dry purifiers, with their water seals, covers and lifting apparatus. The same thing has repeatedly attracted attention here and led to endeavors to increase the efficiency of the liquid treatment so as to accomplish the whole of the purification by this means and render the dry purifier unnecessary. But these gentlemen appear to have gone to work on different lines, and endeavored to design apparatus which should secure for the dry method some of the advantages incidental to the wet—such as lower first cost, less ground area, and therefore smaller covering buildings. Mr. Beatley's design might be appropriately termed a "dry scrubber," though in a different sense to the common acceptation of that term by gas engineers.

The dry purifier, retaining substantially the original form as introduced by Reuben Phillips, still finds universal favor in England. Various details of arrangement for economizing space and labor—such as putting the boxes on the first floor, and using the ground below as a revivifying shed, or putting a revivifying floor above the purifiers—have been adopted. The assistance of conveying machinery has also been called in. Modifications in detail, like Cripps's grid valve, have been introduced. The use of a small percentage of oxygen or air has been resorted to as a means of prolonging the life of the purifier, and thus saving labor and reducing the risk of nuisance. The washer and scrubber have been made to take a larger share of the work of purification; but the set of dry purifiers remains as the last or finishing process in the purification of coal gas. We do not wish to put forward this arrangement as perfect or incapable of improvement. The capital out lay for land, plant and covering buildings is considerable. Where land is valuable, and masonry or ironwork is expensive, it becomes a serious matter. These conditions very rarely obtain in England, and perhaps that is one of the reasons why no special endeavors are made in the direction of cheaper or less bulky plant. A liberal outlay on purifiers is proved to be an excellent investment. It secures an ample return in the shape of economy of labor and purifying material, while it minimizes nuisance and practically guarantees a pure gas. The chief objection is the risk of nuisance. There is something crude and barbarous about the idea of allowing a box full of gas to go to waste when the vessel is shut off, and a further blowing off of gas for displacing the air when it is turned on again. There is not only the loss of gas, but its presence is recognizable in the vicinity of purifier houses; and if the neighborhood is closely inhabited, there is sure to be some complaint and annoyance. This applies in a less degree to the discharge of the spent material. If the washing and scrubbing plant is efficient, and the purifying area of proper proportion as compared with the make of gas, there need be no very marked nuisance in regard to the discharge, removal or revivification of purifying material; but that of the escaping gas is unavoidable.

The question appears to turn on the number of changes that must be made in the course of a year. It is evident that the nuisance and loss of gas incidental to the present system will vary *pro rata* with the number of boxes shut off and emptied. If the present rate is 20 a year, and a plan of working is devised which renders 10 sufficient, the nuisance is diminished by one-half. If 40 changes are found to be necessary, it is doubled. These will be influenced by two causes—quantity of gas to be treated and percentage of impurities remaining to be removed. The circumstances of working are such that variations in these respects have a much wider effect upon the number of changes than might be expected. If the make of gas is doubled, there will be considerably more than twice as many changes; and the same as regards the percentage of carbonic acid and sulphureted hydrogen at the inlet to the purifiers. A change in the description of coal used, or method of working, which only increases these to the extent of 10 or 20 per cent., may mean twice as much trouble in the purifier house. And if by improved washing and scrubbing one reduces them to a corresponding degree, there may be a considerable economy. It is not the quantity of gas alone, but the work to be done on it, that has to be considered in connection with any question relating to purification. Whether the proportion of sulphureted hydrogen is 0.4 or 0.9 per cent., and the carbonic acid 1 or 3 per cent., makes all the difference in the world. The exigencies of the case are such that the gas must be purified as fast as is made. If it were possible, by the aid of a relief holder for the storing of the foul gas or otherwise, to adjust the rate of speed through the boxes to their capacity or to the condition of the material, or to cease purifying altogether for an hour if desired, one can conceive that purification would be rendered easier. But the gas must be operated upon *en voyage* from retort to gasholder; and therefore the plant must be equal to dealing efficiently with the maximum production. The avoidance of nuisance is the chief direction in which to look for improvement on the existing system, whether by means of a continuous process in closed vessels or otherwise. As regards labor saving machinery, this can be applied with equal facility to one system or the other. Local circumstances must determine the value of the economy in ground space and cost of buildings. So before making a radical change by introducing continuous feeding mechanical purifiers, in place of the present intermittent method, it is well to make sure that we are doing all that is possible with the existing system. No regular rule can be laid down, because circumstances vary so widely in different places. But many engineers, by careful development of the various points above instanced, have gradually come down to a very few, perhaps not a dozen, changes per annum, of which not more than two would come in the hot summer weather, when nuisance is most likely to arise. Even under the best working, there is considerable expense attached to the filling and emptying of a purifier. Many claim to purify for nothing—which really means that they make enough profit on the sale of spent material to cover the cost of labor, and not that their labor costs nothing; so anything that will economize by saving labor will still be an advantage to them. The actual net cost of purification is not a fair guide in comparing one system with another; but we must figure on the gross cost of labor, repair and maintenance of tools, etc., as the profit from sales of spent materials would be available in any case, without regard to the system used.

There has also been a considerable advance in the direction of reducing the number of boxes employed. Three or four, of comparatively large area, now take the place of a larger number of small vessels. The day of sets of six, eight, or more purifiers has passed away. We remember once visiting a gas works boasting no less than 23 boxes; but this has all been altered long since. The new mechanical processes, however, go further, and claim to conduct the whole process in one vessel. Mr. Beatley says that since one condenser and one washer are held to be sufficient, so there need be only one purifier. Looking at the responsible nature of the work devolving upon a set of purifiers, we think the single purifier notion to be a delusion. Why not carry the argument to its full extent, and have only one steam engine, one boiler, one exhauster and one gasholder? No one would think of not putting these in duplicate, if expected to guarantee continual service, and if this is so, what is to be said about a mechanical purifier, including machinery for delivering, spreading and ejecting the purifying material? Machinery of all kinds must stand off at times for cleaning and repair, to say nothing of its liability to get out of order or to break down. If there is not a duplicate vessel available at a minute's notice, what is to be done should some of the internal parts ever become deranged? No gas engineer cares to have all his purifying "eggs in one basket." In the case of a set of boxes worked by a single center valve, there is some risk of foul gas getting straight through; and the difficulties in this direction have led to a general preference for at least a second valve, or for a catch box. We cannot see how it would be possible to do with less than two such purifiers, with a catch box of the ordinary type in addition, which means three boxes in all, and is getting within measurable distance of the present system, including valves, connections and seals, if the sulphur clauses are to be respected. The claim that the days of four purifiers are numbered, seems to take too sanguine a view of the responsibilities involved in keeping up a continuous output of properly purified gas from one year's end to the other. We do not believe it would be possible to design a single vessel that would apply oxide or dry lime in such a manner as to compare on any terms of equality in respect to efficiency and reliability with the present system. The responsibility of gas engineers is very great in England. They are watched most closely, and if a single vessel system was in use to any great extent, the fines for

1. From the *Journal of Gas Lighting*.
2. See JOURNAL, Nov. 8, 1897, p. 727.
3. See JOURNAL, March 14, 1898, p. 416.

impure gas would be much more frequent, and instead of being exceptional would become a common occurrence. There are many companies which have existed for half a century or more, and yet have never been convicted of selling impure gas. The present system may be complicated and costly, but it has certainly proved efficacious; and, therefore, looking at the issues concerned, there is a reluctance to throw it over in favor of another way of working. Its cost, if considerable, figures out to a very small proportion for each 1,000 cubic feet of gas made; but in this matter the question of cost, within reasonable limits, is not the first consideration. Efficiency and reliability in action are more important.

As regards first cost, the mechanical system does not offer much prospect of economy. The mechanical parts must be strong and substantial. Finished machinery is costly as compared with rough castings; and the feeding, spreading and ejectment devices would take a great slice out of the saving effected by any reduction in weight of iron and in area of land covered. The machinery must be limited in respect to size and weight, which means a multiplication of moving parts. When we come to working expenses, wear and tear, etc., the case is altogether against machinery. It requires regular supervision, oiling, etc.; and there is also the cost of the power to drive it. A device comprising several moving parts that must be under regular daily attention does not compare favorably with boxes that can be left to themselves for several months at a time. A mechanical purifier, including feed-screw above and rotating grids or rockers below, even if it avoided all loss or smell of gas, would add greatly to the responsibilities of the management. For these reasons we think it will be a long while before gas engineers, in England or elsewhere, will think about resorting to a continuous mechanical system for dry purification as an improvement on the intermittent one. In saying this, we do not wish to discourage attempts to improve upon existing practice. We are open to conviction; and if the ingenious devices proposed by Mr Shelton and Mr. Beatley should pass beyond the paper stage, to be constructed and put into practical operation, we should look with interest for statistics as to first cost and working expenses, in order to compare with present working.

Charging for Electric Power in Buffalo.

Iron Age says that the Cataract Power and Conduit Company, of Buffalo, has at last been able to formulate a statement of the rates it will charge for Niagara power in Buffalo, this Company being distributing agents for the transmitted force in that city. For some little time the Company has been making a careful investigation, aiming to secure to all who may desire to use electric power in Buffalo the advantage of cheap power supplied under a definite and absolutely invariable schedule of charges so adjusted as to impose upon each user a charge equitably proportioned to the service rendered.

The Company has found that to establish a system of charges which shall favor no one class of power users at the expense of others is a matter of considerable difficulty in view of the great variety of service required. As patrons the Company has street railway companies, lighting companies, flour mills and factories requiring thousands of horse power, and a large number of manufacturing and other establishments using power only in small amounts. Furthermore, some of these customers require power continuously during the 24 hours of the day, while others use power intermittently, in some cases averaging two or three hours per day. As a result of the wide range in the amounts of power which must be kept available for various users of the radical difference in hours of use, neither the so-called flat rate system of charges, under which each user is charged a certain amount per horse power kept at his disposal, nor the ordinary method of charging by meter, under which each user pays a certain amount, fixed by schedule, for the actual number of kilowatt hours or horse power hours used, as recorded by meter, can be adopted without imposing upon one or more classes of users of power charges which are relatively excessive.

The Company admits that it has been able to devise no practicable system of charging simply by meter because of the fact that if the charge per horse power hour be so adjusted as to yield the proper and necessary revenue in the case of a customer using power continuously, it will not yield sufficient revenue to cover the actual cost of the power in the case of the customer who uses the power only for a few hours a day. It is the Company's belief that it can more justly charge $40 per horse power per annum to a customer who requires 300-horse power and uses it 24 hours in the day, than to charge the same price to a customer requiring the same amount of power for intermittent use. In the latter case it feels the charge would be excessive. In formulating the rates it has been actuated by a belief that it is proper and also necessary that the charge per horse power should be somewhat greater in the case of customers using small amounts of power than in the case of customers using relatively large amounts of power, but the difference it has made is only sufficient to cover the relative cost of making connections, general expenses, etc. The schedule has as its basis the accurate determinations made by expert engineers of the cost of power as produced by steam in a large number of existing steam plants, not only in Buffalo and vicinity, but in other places, as, for instance, in the cotton mills of New England and the iron mills of Pennsylvania. The conclusion has been reached that even the most modern steam plant will find it advantageous to substitute Niagara power.

The rates given are for Niagara power as distributed from the Company's sub-stations. This is supplied in the form of 3-phase alternating current. All payments for power are to be made monthly, and the amount of each payment is to consist of "a charge for service" and "a charge for power." The charge for service is $1 per kilowatt per month, which is about 75 cents per horse power per month, and this charge will depend only upon the amount of power which the customer may require the Cataract and Power Conduit Company to keep available and ready for use.

The monthly charge for power will depend upon the actual amount used, as determined by standard meters installed by the Company upon the premises of the consumer. These meters will record the number of electrical units which are actually taken by the consumer. The standard electrical unit of power is the kilowatt hour. The charge for power will be determined by the record of the meter and by calculation from the following table:

For use not exceeding 1,000 units the rate shall be 2 cents per unit.

For use exceeding 1,000 units, but not exceeding 2,000 units, the rate shall be: For 1,000 units 2 cents per unit, and for the excess 1.5 cents per unit.

For use exceeding 2,000 units, but not exceeding 3,000 units, the rate shall be: For 2,000 units 1.5 cents per unit, and for the excess 1.2 cents per unit.

For use exceeding 3,000 units, but not exceeding 5,000 units, the rate shall be: For 3,000 units 1.2 cents per unit, and for the excess 1 cent per unit.

For use exceeding 5,000 units, but not exceeding 10,000 units, the rate shall be: For 5,000 units 1 cent per unit, and for the excess 0.8 cent per unit.

For use exceeding 10,000 units, but not exceeding 20,000 units, the rate shall be: For 10,000 units 0.8 cent per unit, and for the excess 0.75 cent per unit.

For use exceeding 20,000 units, but not exceeding 40,000 units, the rate shall be: For 20,000 units 0.75 cent per unit, and for the excess 0.7 cent per unit.

For use exceeding 40,000 units, but not exceeding 80,000 units, the rate shall be: For 40,000 units, 0.7 cent per unit, and for the excess 0.66 cent per unit.

For use exceeding 80,000 units the rate shall be: For 80,000 units 0.66 cent per unit, and for the excess 0.64 cent per unit.

Recording Instruments for Pressure, Temperature, and Electricity.

At a meeting of the Stevens Engineering Society (Hoboken, N. J.), a synopsis of the proceedings of which meeting can be found in the *Stevens Indicator*, for April, Prof. W. H. Bristol read a paper on the matter named in the heading. The Professor stated that although he was going to speak about the "Bristol recording instruments," he would not have us infer that there were no others; in fact, he said, there were many other makes, good and otherwise, but as the only ones he was capable of speaking about were his own, he was afraid that he must confine himself to an explanation of *their* actions only.

A recording instrument has the advantage over an indicating instrument, in that while the latter merely shows the condition of affairs at the present instant, a recording instrument keeps a record in view, on which we can not only read the present condition of affairs, but also note how the conditions are changing. The recording gauges are very useful in connection with steam boilers for obtaining a continuous record of pressure, which necessitates good firing, and therefore saves fuel, as well as wear and tear on the boiler, by causing the pressure to be kept nearly constant. By requiring constant vigil on the part of an attendant the recording instruments may be said to also promote safety and efficiency.

The recording pressure gauge was first shown, and attention was called to the simplicity of its construction, no complex or delicate mechanism being employed. A light sinusoidal tube of brass is firmly fastened at several points to an inextensible strip of metal. The pressure being applied inside the sinusoidal tube tends to lengthen it, and being held by the metal strip, this differential action causes the two to bend, thus moving the pointer. This style of instrument is adapted for a range of 12 to 350 pounds per square inch. To measure lower pressures, a diaphragm gauge is used, which is so constructed that a small pressure acts on a large area. The gauge shown registered pressures up to 2 ounces. These gauges are very useful to keep a record of the pressure in gas mains. By exhausting the air from inside the diaphragms, this gauge can also be used as a vacuum gauge, and the one shown gave a movement of 1½ inches of the pointer for a vacuum of 2 inches of mercury. The two gauges, pressure and vacuum, combined are used in recording the pressures of inlet and outlet air in mine ventilation.

For pressures above 350 pounds, for which the sinuous tubes would have to be so thick that they would take a set, a helical tube is used, which, under pressure, tends to unwind. This form is made to register up to 5,000 pounds.

The diaphragm type of gauge may be used, in connection with a small attachment, to measure the variation of depth of tide water, or to measure the height of water in fire tanks or reservoirs, etc.

Specimens of recording thermometers were next shown. These are ordinarily used for temperatures of 32° F. to 212° F., and they can be read to one-fifth of a degree. These instruments need not be placed necessarily at the point where the temperature is to be recorded. If, for instance, it is desired to record the temperature outdoors and have the recording instrument inside, a bulb is placed at the desired point and connected with the instrument by a capillary tube, and the bulb, tube and instrument filled with alcohol. When the temperature varies the pressure in the bulb varies and is transmitted through the capillary tube to the helical coil in the instrument. Such instruments are used up to 600° F., and the error is practically eliminated by making the volume of the bulb many times greater than that of the tube. This form is used often in kilns, ovens and rubber vulcanizers.

Three electrical recording instruments for direct current were shown. In the voltmeter, the pointer was deflected by the attraction between two coils in series, through which current was shunted as in ordinary voltmeters. In this the movement per volt change of pressure increased very greatly as the potential was raised, enabling the readings at ordinary working pressures to be read very accurately.

The ammeter pointer was moved by the attraction of a disk and a small core of soft iron by a low resistance coil; the combination of disk and core making the readings for single amperes practically constant. These instruments are made to 3,500 amperes capacity. In the wattmeter the current flowed in series through a fixed coil, and a current was shunted through a movable coil carrying the pointer, the mutual attraction of these coils moves the pointer. For alternating current work fewer turns are used on a coil, so that the effect of induction will not be felt.

There are now over 150 varieties of these instruments manufactured, in order to meet all possible commercial requirements, and new types are being put on the market every little while.

Japanese Petroleum.

The *Am. Mfr.*, in a well-compiled account of the petroleum industry of Japan, states that the deposits are found in the province of Echigo at four points or districts. One of these is located between 5 and 6 miles from the town of Nagaoka, where there are some 60 wells at work, situated on steep hillsides. During 1894 and 1895, the wells were very productive, the output being about 30,000 gallons a day. Latest reports, however, show that the production is decreasing, and it does not now exceed 10,000 gallons per day. Pumping has to be maintained continually in these wells, which vary from 600 to 1,500 feet in depth; and in some the flow is so trifling that pumping can only be carried on intermittently. This inadequate flow of oil appears to be a characteristic of most of the Japanese wells. Not far from here some wells sunk 400 to 600 feet, less than two years ago, gave very good returns even before pumps were fitted; but after a few months the flow slackened, and the production appears to be rapidly decreasing. In these new wells the quality is fairly good, and in some excellent, the analysis showing 70 to 75 per cent. of illuminating petroleum, while the wells first mentioned do not average more than 54 per cent. But the method of refining the oil is very ineffective, the process being carried on in small private stills, and it is found necessary to mix it with 40 to 50 per cent. of American oil before it can be used for illuminating purposes. A new refinery, however, is in process of construction at Nagaoka, with machinery made in Japan, capable of dealing with from 7,500 to 8,000 gallons of crude oil daily; and it is asserted that the oil in this refinery will be brought up to the American standard. There is also a refinery, with a capacity of 4,000 gallons a day, at Niigata, where a part of the crude oil is effectively treated.

The second district from which oil is obtained is situated at Idzumosaki and Amasemachi. The same results have followed the working of the wells in this district as in that first named. Before the wells had been worked 10 years the production showed a great falling off, and not only have many of the wells been abandoned, but the new wells sunk have given very poor returns. It is doubtful if the whole output of this district exceeds 5,000 gallons per day. Possibly, if deeper boring were attempted, the results would be improved. The deepest well in this locality is 2,400 feet, and from this the best oil is obtained, the others varying in depth from 400 to 1,800 feet. In quality there is great diversity among these wells, some producing only 45 per cent. of illuminating oil, while the best reach a limit of 75 per cent., the oil being treated in a good, though small refinery on the spot.

The Japan Petroleum Company has control of a district situated from 10 to 12 miles from that first mentioned, where there is an output of not more than 1,500 gallons per day. The product is of an inferior quality, and there are expectations that this district will shortly be abandoned as not worth further development.

Some 40 miles distant from the first named district is to be found a number of wells where, though the flow is superior to all the others mentioned, the quality is exceedingly poor. The output is about 25 per cent. of illuminating oil, and 40 to 50 per cent. of lubricating oil. The latter is difficult to dispose of, as it is sold unrefined, and factories with complicated machinery use only the American product. Even when employed for lubricating rough machinery, the Japanese oil is mixed with American. It costs about half the price of the latter product.

It has been stated that the total output of the Echigo fields is from 650,000 to 700,000 cases refined yearly; but American experts who have thoroughly investigated the field are convinced that the supply is neither sufficiently plentiful nor promising to warrant being treated with expensive machinery. Presuming the yield of all the Echigo wells to be from 650,000 to 700,000 cases, it still represents only one-eighth part of the total import of foreign petroleum, which in 1896 amounted to 5,462,000 cases. Taking this fact into consideration, it does not seem that there is likely to be much competition between the foreign and the Japanese product, 80 per cent. of the latter being consumed by Echigo and the surrounding provinces alone, while the remainder is placed at a disadvantage, owing to the difficulty of transport. At the wells the price of crude oil varies from $1.25 per 50 gallons to $3.07, according to quality. The refined article is sold retail in the districts of production at from $1 to $1.02 per case; but when it comes into competition with American, Russian and Langkat oil at Osaka, it is found necessary to sell Echigo product at 92 to 95 cents per case, notwithstanding that the cost of freight, insurance, leakage from Niigata, the port of shipment, to Osaka must reach to 7 cents per case at least.

History of the Portland Cement Industry in the United States.

Mr. Robert W. Leslie, C. E., in a paper read before the Mining and Metallurgical sections of the Franklin Institute, gave a most interesting review of the development of the Portland cement industry in the United States. A succinct abstract of his paper is appended:

To the non-engineer cement is generally associated with the numerous works of the Romans, but, in point of fact, the mortars used in the Roman construction were not of cement at all, but were mixtures of slaked lime and pozzuolona, a volcanic dust which was found in large quantities in Italy. It was not until the end of the last century that the true principles of hydraulic cement were discovered by Smeaton, who, in the construction of the Eddystone Lighthouse, made a number of experiments with the English limestones, and laid down, as a result, the principle that a limestone yielding from 15 to 25 per cent. of residue when dissolved in hydrochloric acid will set under water. These limestones he denominated hydraulic limestones, and from the principle so laid down by him come the two great definitions of what we now know as cement, namely, the natural and artificial cements of commerce.

The first class of cement, the natural, such as the Rosendale, Lehigh and Cumberland cements, was first made by Joseph Barker in 1796, who discovered what he called "Roman cement," based upon the calcination at low temperatures of the nodules found in the septaria geological formation in England. This was practically the first cement of commerce, and gave excellent results. Subsequent to the discoveries by Smeaton, General Sir William Paisley went into an exhaustive series of chemical and other tests to determine how artificial cements could be produced which would correspond to the higher grades of hydraulic limestone described by Smeaton and the Roman cement which was then commanding the market. Contemporaneous with him and working in the same scientific field was Vicat, a French engineer, who conducted investigations of the same general character and, in his book on hydraulic limestones and cements, describes his many experiments which led to the scientific development of a Portland cement artificially made by calcining mixtures of chalk and clays at high temperatures to incipient vitrifaction.

While these experiments were going on, Joseph Aspdin, a bricklayer or plasterer, took out a patent in England in 1824 on a high grade artificial cement, and, at great personal deprivation, succeeded in manufacturing it on a commercial scale by combining English chalks with clay from the river beds, drying the mixed paste, and after calcining at high heat the material thus produced, grinding it to powder. This cement, which was the first Portland cement in the market, obtained its name from its resemblance when it became stone to the celebrated Portland stone, one of the leading materials in England.

The growth of the natural or Roman cement industry in England was more rapid than that of the Portland cement, and in the early days of Portland cement that article was sold at prices considerably lower than those of the Roman cement manufactured by Parker and his successors in the business. It was not until many years after Smeaton's discovery that there was much growth in the Portland cement industry. A few works were started in England, and a few more were started on the Continent, by friends or relatives of Aspdin, but the demand was very slight, and there was a doubt in the minds of engineers as to the character of the material.

Along in 1850, when the question of building the London drainage works came up, John Grant, the engineer, decided to use Portland cement in its construction, and his two papers, published by the Institute of Civil Engineers, form the first scientific literature on the subject of cement testing, and were the first to put Portland cement to the front as a material upon which engineers could rely to the fullest extent.

In this country we make the natural cements similar to the Roman cement of Parker, and also the Portland cement of Aspdin. The laminated rock from which among others natural cement is made, is calcined in open kilns, like lime kilns, a moderate heat only being used. The product is then ground, put into barrels, and is ready for shipment. The rocks used in the manufacture of Portland cement are very similar to those from which natural cement is made. The various layers in the natural rock may vary in size or stratification, so that the lime, alumina and sillica may not be in position to combine under heat, or there may be too much of one ingredient, or not enough of the others in close proximity to each other. In making Portland cement these rocks, properly proportioned, are accordingly ground to an impalpable powder, the natural rock being broken down and the laminae distributed in many small grains. This powder is then mixed with water, and is made into a new stone in the shape of the brick or block, in which all the small grains formerly composing the laminae of the original rock are distributed and brought into a close mechanical juxtaposition to each other. The new rock thus made is put into kilns with layers of coke, and is then calcined at temperatures from 1,600° to 1,800°. The clinker, as it comes from the kiln, is then crushed and ground to an impalpable powder, which is the Portland cement of commerce. Portland cement may be made from other materials, such as chalk and clay, limestone and clay, cement rock and limestone and marls and clays. In every case the principle is the same—the breaking down and the distributing of the materials so that they may be in close mechanical union when subjected to the heat of the kiln.

The first branch of the industry to develop in this country was the natural cement, and its inception was largely because "necessity is the mother of invention." The first large public works built in this country were the canals, and the most necessary thing to build a canal was mortar that would hold the stones together at the locks, or walls, under water. Consequently, wherever canals were to be built, there was a search for cement rocks, and all the earliest works in this country were established on the lines of canals. Thus on the Chesapeake and Ohio Canal are the Cumberland and Round Top works, on the Lehigh Canal the works at Siegfrieds and Coplay, Pa., on the Richmond and Allegheny the works at Balcony Falls, Va., on the Delaware and Hudson Canal the large group of works at Rosendale and Kingston, and on the Falls of the Ohio Canal, the large aggregation of works about Louisville. From this same fact grew the early package used in shipping cement in this country, the barrel, which was the package best adapted to water transportation, and it took many years, even since the railroads came, to overcome the prejudice for this form of package and to substitute the paper or duck bag for the barrel.

The growth of the natural cement industry has been very rapid, having increased from 3,000,000 barrels in 1882 to about 8,500,000 barrels in 1896. The first Portland cement involved a great cost of labor, and could not be offered at prices very much below the foreign article, and as the Portland cement in a building costing $1,000,000 to $1,500,000 represented only a small percentage of the total cost, and as the difference between the American and the foreign article represented only a small percentage of this amount, it was almost impossible to convince engineers and architects that American Portland cement should be used. It is an interesting fact that among the first great works to use American Portland cement were the jetties built by Captain James B. Eads, and among the first buildings in which American Portland cement was used was the Drexel Building, Philadelphia. By slow degrees, however, the prejudice in favor of the imported Portland was overcome and the American industry showed its right to exist.

The first American Portland cement plant was that of the Coplay Cement Company, of which Mr. David O. Saylor, of Allentown, was the president. This plant was established about 1865, and made natural cement of excellent quality. Mr. Saylor, who was a man of indomitable energy and great ability, made up his mind in the early 70's that he could make Portland cement in this country, and his first experiments are most interesting. He knew that by burning to incipient vitrifaction the rocks of the quarry he could make a cement that at short periods showed tensile strains equal to the imported Portland, but he found this cement would crumble away as time went on, owing to the variation in the raw material. By sheer force of his native ability, Mr. Saylor studied out and successfully applied to the Lehigh rocks the principle above mentioned as governing the production of Portland cement, though dealing with a material never before used for the purpose, and the process was that which I have just described, and which is still in use in some of the largest works in the Lehigh district. Mr. Saylor's work was materially aided by Mr. John W. Eckert, a graduate of the Lehigh University, who became first the chemist and afterward the superintendent of the Coplay Cement Company, Mr. Sayler's concern at Coplay station, which he subsequently left to join in the establishment of the American Cement Company.

While this experiment was being carried on to success in the Lehigh region, and the foundations were being laid for the large industry that now exists, a small works was erected near Kalamazoo, Mich., in 1872. Owing to the character of the material and the high cost of labor and fuel, this works made cement which was too expensive commercially and did not succeed. Early in 1876 works were started by Mr. Shinn, at Wampun, Pa., near Pittsburgh, using limestone and clay. These works are still going, though they have not been very materially increased since their inception.

At South Bend, Ind., Thomas Millen, an Englishman, found a white marl and a blue clay which resemble in composition, though not quite in form, the materials used for cement making in England. He started a small works there in 1877, and the plant is still running, though not having grown much. Mr. Millen later transferred his field of operations to New York State. The Rockland, Me., lime is well known as one of the best and purest in the country, and it was but natural that the Portland cement industry should seek a lodgment in that field. The Cobb Lime Company, an important concern there, started works in 1879, but the product was too dear for commercial success, and they were closed down. For similar causes a similar fate overtook the National Cement Company, which was established by Mr. S. D. Coykendell and others on the Hudson, in the well known natural Rosendale district. Thus it may be seen that out of the six original works started in this country prior to 1881, three were failures, and certainly the industry, with this percentage of loss, did not offer very encouraging outlook to the investor. At this period the foreign Portland had the market exclusively, and there seemed little likelihood of growth.

Patents were necessary to enlist capital in the earlier enterprises, and many of the earlier works were founded on them. The great difficulty in all the American enterprises seemed to be the cost of getting the raw material into powder, then into paste, then into bricks or blocks, and

then into the kiln with a sufficient economy. About 1884 and 1885 patents were taken out by Messrs. James M. Willcox, E. J. Smedt and Robert W. Lesley for the purpose of mixing liquid hydrocarbons with the paste. In this way a "slurry" was made which, when compressed into balls or eggs, could be at once put into the kilns, and thus many of the intermediate steps of drying, etc., were dispensed with and much labor and money saved. These processes, which were used in the works started by the American Cement Company, at Egypt, Lehigh county, Pa., under the management of John W. Eckert and Robert W. Lesley, were based upon the use of the by-products of the manufacture of coal gas, but with the introduction of water gas and the consequent advance in the price of coal tar the processes were abandoned and other methods adopted. But the enterprise proved successful and the Company now controls five large works, four at Egypt, Lehigh county, Pa., and one near Syracuse, N. Y., and is one of the largest producers of Portland cement in the country.

While these methods of saving the intermediate processes of drying were being used, other inventions by Mathey, Navarro and Ransom in the same direction gave rise to the establishment of the Atlas Portland Cement Company, which has two large works in the Lehigh region, and is another great producer of cement. These processes, based originally on the calcination of the crushed raw rock by oil in revolving kilns, were at first unsuccessful, the cement proving unreliable for the same reason that gave Saylor so much trouble originally. Subsequently, however, improvements were made whereby the material was ground to an impalpable powder and slightly moistened before being run through the kiln, and cement made in this way has proved successful, and is made in large quantities in this country.

We have in this country many materials for the manufacture of Portland cement—oyster shells, marl, limestone, chalk and cement rocks forming the lime base, and clay and cement rocks forming the argil laceous element. These materials may be be said to be found over almost all the United States, and, broadly speaking, they are treated in one or the other of the two ways just described, either by the process used by Saylor, which is practicaily the process used all over Europe and under which Portland cement won its great reputation, or by the process of Mathey and Ransome with revolving kilns. There are variations, of course, in these processes, such as the substitution in the first one of perpetual kilns under the Dietsch, Schoeffer or other patents, and the substitution of pulverized coal for oil under other patents and processes in the second one, but the principles of the two methods remain the same and are those in general use throughout this country.

At present the principal cement district in the United States is the Lehigh District, where in a line from Whitehall, on the Lehigh Valley Railroad to Vulcanite, on the Central Railroad of New Jersey, are to be found some 13 works, which produce practically two-thirds of all the Portland cement made in this country. The next largest district is that of New York State, where, in the low lying country between Syracuse and Buffalo, five large works are manufacturing cement from the marl and clay there found. In Ohio, near Sandusky, are three works making cement from marl and clay, and similar materials are also used at works in Michigan and Indiana. There are also Portland cement mills in Utah, California, Arkansas, Texas and South Dakota. The industry has grown from an output of 85,000 barrels in 1882 to 1,593,023 barrels in 1896, and during the present year a considerable increase over this latter figure is expected.

The American product is beginning to represent a large percentage of the consumption of Portland cement in this country, and it seems only a question of time when it will ultimately supersede in many markets the foreign article. It may be said now to be an established industry in this country, and one deserving the success that it has shown its right to have. Its capabilities in this country are very large, and its past has shown that its development will depend upon careful management, both scientific and practical, inasmuch as the successful works have won their success upon these elements, as well as upon their proper geographical location with regard to raw materials and proper distributing markets.

The Working Value of Fuels.

By Mr. Thos. Fletcher, F.C.S., in *Gas World*.

Heating Living Rooms.—In some experiments carried out at the New York State Veterinary College it was found that the heat lost by ventilation was 39 per cent. of the whole, and my attention has been called to the fact that these figures, which may be taken as correct, differ seriously from those given in my book on the "Commercial Uses of Coal Gas," where the amount lost in Messrs. Walker's bottling stores is given as varying from 22½ per cent. to 25 per cent. The explanation is simple. The minimum ventilation required in living rooms is 500 cubic feet of air per hour, for each adult; in bottling stores only a fraction of this is required—in fact, no provision whatever is made for ventilation, and all which takes place occurs from leakages and from the constant opening of doors for the passage of trucks and barrels. The figures given by me are clearly stated as being observed results in practice in bottling stores only. I had no opportunity, before the book was published, of making any exact experiment in living rooms, these being very difficult, if not impossible, under ordinary conditions in any house, the speed of the air currents in the flues varying almost from minute to minute.

Recent experiments in rooms where the ventilation is controlled, and can be measured, have established a rule which may be safely relied on for every practical purpose. The accepted standard is the British thermal unit—*i. e.*, the amount of heat neeessary to raise the temperature of 1 pound of water 1° F.; and one unit is required per hour for each degree rise of temperature, over the outside, for each square foot of glass, or for every 4 square feet of exposed wall, and two-thirds more for the loss of heat by ventilation in ordinary living rooms. The loss of heat in living rooms is an unknown quantity, as it varies in every room, and in the same room from hour to hour; but taking the theoretical value of coal gas at 660 British thermal units per cubic foot, that of coal at 13,000 units per pound, and of coke at 10,000 units per pound, it becomes easy to calculate the effective value and the loss of heat in different systems.

A flueless gas stove may be taken as the highest type of efficiency, and, using this, 1 cubic foot of gas per hour will be required for every 600 square feet of glass, or for every 2,680 square feet of exposed wall, for every 1° rise of temperature over the outside, and, in addition to this, two thirds of a cubic foot for loss by ventilation. Taking a room 22 feet square and 10 feet high, with all walls exposed, 2 cubic feet of gas per hour will maintain a rise of 3° over the outside, allowing for the average window surface. The exact figure for warm air stoves, with flues, and for open fires are not available, and perhaps not possible, but for average practice it may be taken that nearly one-half the total heat is lost in a warm air stove with a flue, and two-thirds with an open fire. This can hardly be considered as all loss, as the ventilation necessary for comfort and health cannot be always obtained without some assistance, and the so-called loss may be partly taken as useful work done. The whole subject is beset with variations and difficulties, and any standard can be proved to be seriously wrong in individual cases; but the figures given may be taken for average work. It must be clearly understood that the figures given are for maintaining the heat, not for raising the temperature of any room quickly, for which a much larger fuel consumption is required.

Heating Plant Houses.—These figures work out in practice in greenhouse heating, where steady temperatures are required night and day, and where the loss from any system of boilers or stoves can be readily calculated, a matter of interest to nurserymen, whose fuel consumption is a question of vital importance. The loss in most forms of boiler is enormous, and the subject needs careful consideration. For this purpose the calculation is exceedingly simple, on the basis of 10,000 units per pound of coke. One pound of coke burned per hour will give a rise of 10° for every 1,000 square foot of glass, or for every 4,000 square feet of exposed wall, not allowing for loss by ventilation. For this one half more fuel must be allowed; this gives us the maximum possible duty, and a comparison with the fuel burned gives the waste. Where the flue heat is not utilised there is no doubt that at least 50 to 60 per cent. of the fuel is completely wasted in most of the systems at present in use, and the value of the fuel is not considered as it should be. In my own case, with a Chatworth boiler, burning gas coke, and heating a range of houses 45 by 30 feet, one-half of which is kept at a tropical temperature, the flue heat not being used, the calculated consumption is 8 pounds per hour by theory, allowing one-eighth loss for wind, as the houses are on high ground and rather exposed. This wind allowance will vary in different districts. The actual winter average is 11¼ pounds per hour, showing a waste of 31¼ per cent., nearly one-third of the fuel; this being with a first class boiler, clean, well set, carefully fired, and of the correct size for its work. It is doubtful if better results could be obtained in practice under any ordinary conditions.

The following rule may be taken as a guide for coke-fired greenhouse boilers: For every 1,000 square feet of glass, and for every

4,000 square feet of exposed wall, for each 10° rise of temperature over the outside:

Loss through glass and walls	16 ozs.	per hour.
" by ventilation	8 "	"
" by wind (average)	3 "	"
" by boiler and flue	13 "	"
Total	2½ pounds	per hour.

Three-fourths of the flue loss can be recovered by taking these under the beds of the houses.

Any fuel consumption over this may be taken as waste which can be prevented.

The Chemistry of Gas Making.

By Mr. G. E. Brown, F.I.C., in *Journal of Gas Lighting*.

A Chapter for Students.—The chemistry of the processes involved in gas making is no doubt the most difficult part of the subject to the average student of gas manufacture, who is usually an engineer rather than a chemist, and whose knowledge of chemical matters is generally no better or worse than a chemist's command of engineering technique. The present article is therefore written not as contributing anything fresh to the chemistry of gas manufaucture, but as a help to those students who may wish to gain an all-round knowledge of their subject for examination purposes or otherwise.

The chemistry of gas making divides itself naturally into (1) chemical processes involved in the destructive distillation of coal or other material, and (2) those concerned with various methods of purifying crude gas. Treating the subject in this way, we have first to say that the chemical changes taking place in the carbonization of coal constitute one of the least understood processes connected with gas making. Coal is a highly complex body. Its ultimate composition can be expressed simply enough—that is to say, we can express its composition in percentages of carbon, oxygen, hydrogen, nitrogen, sulphur and ash, as is done in the numerous published analyses of the mineral. But this is a very different, and a much easier thing than expressing its approximate composition—*i. e.*, saying into what combinations these percentages of the various elements are grouped. Of this we have but little definite knowledge, and hence it is difficult to trace the changes which are produced when coal is heated in closed vessels. Still, certain facts with regard to its destructive distillation have been ascertained and are important. In the first place, coal contains certain hydrocarbons—compounds containing carbon and hydrogen only—some of which are probably hydrocarbons of the paraffine series, of which marsh gas, or methane (CH_4) is the first member. All the members of this series correspond to the general formula, C_nH_{2n+2}. Thus the first three members—the methane, ethane and propane—have respectively the formulæ CH_4, C_2H_6, C_3H_8. When members of this paraffine series are heated, they give rise to a lower member of their own and to hydrocarbons of another series—the olefines—of which ethylene (C_2H_4) is the represenative compound. Then the hydrocarbons of the last named series give rise when heated to lower members thereof and to members of the acetylene series, of which acetylene (C_2H_2) is the simplest representative. The action of heat, however, on acetylene is of a different character to that on the paraffines and olefines. On the former the action of heat is analytic—*i. e.*, destructive—tending to reduce the compounds to simpler hydrocarbons. With acetylene its action is synthetic—*i. e.*, constructive—giving rise to compounds of more complex composition. Acetylene at a red heat is converted into benzene—a hydrocarbon of an altogether higher order of complexity—$3\,C_2H_2 = C_6H_6$.

Hence a little reflection will show that these reactions amply account for the presence in coal gas of methane, ethylene, hydrogen, etc., constituents produced by analytical processes, and of benzene, toluene, etc., bodies owing their existence to synthetic changes. It should further be noted that, when high heats are employed during distillation, the yield of benzene increases; the tars produced at temperatures ranging from about 1,700° to 2,000° F., being richer in benzenoid hydrocarbons than those obtained at lower temperatures (800 F.), in which paraffine and olefine hydrocarbons predominate. This is a natural result of the fact that the formation of benzene goes on at a much higher temperature than that required to give rise to paraffine and olefine hydrocarbons.

The influence of the oxygen, sulphur and nitrogen contained in coal must also be considered. The oxygen is mostly finally converted into carbon dioxide (CO_2) and carbonic oxide (CO); and the higher the temperature of distillation, the larger is the proportion of these bodies, since their formation takes place at the expense of oxygenated bodies, like phenol, in the tar. Nitrogen, which occurs in coal in comparatively small proportion, is distributed in various ways among the products of distillation. The late Professor William Foster stated that 14.5 per cent. of it is evolved as ammonia, 1.56 per cent. as cyanogen, 46.7 per cent. remains in the coke, while the remaining 35.3 per cent. is found in the gas and tar. Here again increase of temperature during distillation has its effect. Ammonia is decomposed at a red heat, though very slowly, when mixed with other gases (Ramsay); but when brought into contact with red hot coal it forms ammonium cyanide and hydrogen:

$$2\,NH_3 + C = NH_4CN + H_2.$$

Hence ammonia rises to a maximum at a modern temperature (one giving about 9,500 cubic feet of gas per ton of coal); while the production of cyanides is greater with higher heats.

Some of the sulphur in coal exists as sulphate of lime, which remains in the coke. The greater proportion, however, exists as pyrites, or as an organic sulphur compound, and on distillation it is mostly converted into hydrogen sulphide (H_2S). Carbon bisulphide is also formed; its production being no doubt due to the direct action of the sulphur vapor liberated from the pyrites on the red hot coke. When the pyrites in the center of the charge is hot enough to yield sulphur vapor, the outer surface of the partly coked mass has acquired a temperature high enough to form carbon bisulphide with it.

Passing now to the chemistry of purification, the principal reagents are, of course, bog oxide, Weldon mud, slaked lime and sulphided lime. The two former remove hydrogen sulphide only. The active agent in bog oxide is hydrated ferric oxide ($Fe_2O_3 \cdot H_2O$), of which a good sample contains about 32 per cent. But only about two-thirds of this is active towards hydrogen sulphide. The reaction between the oxide and sulphide is represented by the following equations:

$$(a)\ Fe_2O_3 \cdot H_2O + 3\,H_2S = Fe_2S_3 + 4\,H_2O$$
$$(b)\ Fe_2O_3 \cdot H_2O + 3\,H_2S = 2\,FeS + S + 4\,H_2O$$

Equation (*a*) is the predominant reaction. When the oxide is revivified by exposure to air, the sulphides of iron are converted into the corresponding oxides, with liberation of sulphur; thus:

$$(a)\ Fe_2S_3 + 3\,O = Fe_2O_3 + 3\,S$$
$$(b)\ FeS + O = FeO + S$$

The ferrous oxide in the latter reaction rapidly changes by absorption of oxygen into ferric oxide.

Weldon mud contains about 25 per cent. of manganese dioxide (MnO_2) in the sample as used. With hydrogen sulphide it forms the flesh colored manganese sulphide, which on exposure to air is rapidly oxidized, with a resulting deposition of sulphur.

Slaked lime, or calcium hydrate—Ca(OH)(OH)—takes up both carbon dioxide and hydrogen sulphide. With the former it produces carbonate of lime:

$$Ca(OH)(OH) + CO_2 = CaCO_3 + H_2O$$

With the latter it forms calcium hydroxy-hydrosulphide and also calcium hydrosulphide:

$$Ca(OH)(OH) + H_2S = Ca(HS)(OH) + H_2O$$
Calcium hydroxy-hydrosulphide.

$$Ca(OH)(OH) + 2\,H_2S = Ca(HS)(HS) + 2\,H_2O$$
Calcium hydrosulphide.

Carbon dioxide turns the hydrogen sulphide out of both of these compounds, thus:

$$Ca(HS)(HS) + CO_2 + H_2O = CaCO_3 + 2\,H_2S$$

This reaction is, however, never quite complete—that is to say, a lime purifier which has been exposed to both carbon dioxide and hydrogen sulphide will not lose all the latter, even if subjected to pure carbon dioxide. This results from the fact that a reverse reaction is possible, and, indeed, takes place in dilute solutions, whereby hydrogen sulphide attacks carbonate of lime, thus:

$$CaCO_3 + 2H_2S = Ca(HS)_2 + CO_2 + H_2O.$$

These changes, which go on in ordinary lime purification, are best borne in mind by representing them diagramatically—a method first used, the writer believes, by Mr. Leicester Greville. Diagram 1 shows the state of things in a four-tiered purifier which has been exposed for a short time to gas containing carbon dioxide and hydrogen sulphide. Diagram 2 represents the state of a similar purifier which is retaining carbon dioxide but allowing hydrogen sulphide to pass by reason of the decomposition of the hydroxy-hydrosulphide by the carbon dioxide.

The composition of sulphided lime, used for the absorption of carbon bisulphide, has long formed the subject of controversy. The most

accurate knowledge we possess on the subject we owe to Veley, according to whom the true absorbent of carbon bisulphide is not calcium sulphide, CaS, or calcium hydrosulphide, Ca [HS][HS], but calcium hydroxy-hydrosulphide, Ca[SH][OH]—a sparingly soluble white body

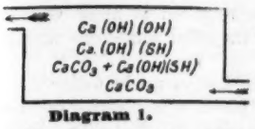

Diagram 1.

Inlet.—Gas containing $CO_2 + H_2S$.
Outlet.—Gas containing no CO_2 or H_2S.

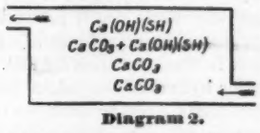

Diagram 2.

Inlet.—Gas containing $CO_2 + H_2S$.
Outlet.—Gas containing H_2S only.

obtained by passing any inert gas such as hydrogen or nitrogen into a solution of the hydrosulphide. The hydrosulphide is itself produced by the action of hydrogen sulphide on milk of lime; its formation being favored by decreased temperature. It is readily convertible into the hydroxy compound by mere exposure to air, the change taking place with evolution of heat and disengagement of hydrogen sulphide. When carbon bisulphide is absorbed by sulphided lime, the compound formed consists of a basic calcium thio-carbonate—$2Ca(OH)_2 \cdot CaCS_3 \cdot 10H_2O$—which forms yellow crystals, dissolving to a red liquid. These researches of Veley explain the hitherto inexplicable inactivity of overfouled lime boxes, or of boxes fouled at low temperatures. In either case, the hydroxy-sulphide has been converted into hydrosulphide. Air regenerates the hydroxy-hydrosulphide, or if the mass is broken up, the unaltered lime combines with and removes the hydrogen sulphide present in excess. Viewed in the light of Veley's work, the difficulties experienced by engineers with sulphided boxes become explicable. The following passage is an example of such difficulties; and by reference to what has been said, the student will be able to trace the the chemical changes concerned: "When lime is sulphided in very cold weather, it absorbs an extremely large quantity of hydrogen sulphide without acquiring energetic affinity for 'sulphur' (*i. e.*, carbon bisulphide.) It has all the appearance of fresh virgin lime; being cold, white, dry and powerless to arrest sulphur. By exposure to the air it becomes dark green, moist, steaming, giving off hydrogen sulphide abundantly, and acting vigorously on 'sulphur.'"

Brazed Copper Steam Joints.[1]

An investigation recently made by Professor Arnold, of Sheffield, on behalf of the Committee of Lloyd's Register of British and Foreign Shipping, appears to point to a new danger in the use of large copper steam pipes. This practice grew up in the days of low steam pressures, and proved for many years very successful. Copper is a metal which has extraordinary powers of standing punishment, as is shown by the comparatively excellent results obtained with it as a material for stay bolts. It could thus be used in a steam pipe with a much less liberality of curvature than the early engine builders found necessary to provide for expansion when cast iron was employed for the purpose. Space being always at a premium on board ship, the use of copper pipes in this way resulted quite naturally, particularly as an expansion joint of the stuffing box type failed to be satisfactory with the older types of packing material. Unfortunately, however, the strength of copper, and still worse, its alloys, falls off somewhat rapidly with increasing temperatures.

Whether the capacity of these materials for taking punishment is equally affected is another matter, since so far there has as yet been no condition recognized in copper corresponding to that arising in the case of steel when warmed to a blue heat. In fact, some recent experiments made by Professor Warren, though not altogether concordant, *inter se*, show no serious falling off in the percentage elongation of copper up to temperatures of 400° F., or more. It is then probable that the many fractures of copper steam pipes which have been recorded since the introduction of the triple expansion engine are to be attributed to the fact that designers, in thickening the walls of their pipes in order to withstand the greater pressures, failed to note that the extra stiffness accompanying this increase of strength required to be compensated for by augmented curvature in the line of piping. Amongst the failures of such pipes which have been investigated by the Board of Trade, by far the largest number appear to have arisen from an oversight of this nature. Once this fact has been recognized there is little excuse for future accidents of a like nature; and in view of the exceedingly fatal results which almost certainly follow, engineers neglecting to provide their pipes with such flexibility are undertaking a very grave responsibility. So far the objections to the use of copper are met easily enough, but the accident to the steam pipe of the Prodano raises questions of a totally different nature. This boat was built at Blyth in 1890, and was engined by the Northeastern Marine Engineering Company. Her steam pipes were examined externally in 1890 by Mr. Walliker, Lloyd's senior surveyor at Cardiff, who detected nothing wrong. Nevertheless, nine months later, one of those pipes burst at sea, killing two engineers and two firemen. At the Board of Trade inquiry subsequently held, the Court came to the conclusion that the explosion was due to the brazing being orignally defective, an opinion which was not thought to be justified by the very experienced engineers who direct the technical department of Lloyd's Registry, and consequently caused them to seek the aid of Professor Arnold in endeavoring to definitely determine whether, as was their contention, brazing originally sound had deteriorated with length of years and service.

That the brazing was sound at the outset seemed to be settled by the fact that the burst pipe had originally been made in a straight length, and afterwards bent, whilst cold, to a sharp curve; but how or why subsequent deterioration should have occurred was by no means obvious. To clear this up, portions of the broken pipe and its fellow were sent to Professor Arnold, together with samples of a brown incrustation scraped from the interior of the latter, some of the cylinder oil used, a sample of "zynhara," an anti-corrosive fluid used in the Prodano's boilers, portions of the main steam pipe from another vessel, specimens of the brazing solder used, and of Muntz metal, both in the newly-cast state and as deteriorated by the action of bilge water. Micrographic examination of the various metallic specimens were made by Professor Arnold. Starting with the sample of Muntz metal, it was found that in the case of the specimens which had been corroded by bilge water, large areas presented an appearance totally different from that exhibited by specimens of the new metal. On examining in the same way the brazed seams of the Prodano's pipes, a similar change was found to have occurred in a large proportion of the solder. Whilst portions of this still retained the original internal structure of the brazing, large areas showed up as a finely granulated, coppery looking mass. Unfortunately, sufficient of this solder could not be obtained from the pipes of the Prodano for an accurate analysis of the original and altered composition of the solder to be ascertained; but as it chanced, the steam pipes of another steamer were found by Mr. Williker to resemble those of the Prodano at his last examination of that vessel. Portions of these pipes were also sent to Professor Arnold, and a similar alteration in the solder established, whilst the amount of solder now available permitted of its being accurately analyzed. When the pipe was new, this solder contained probably about 62 per cent. of copper, an amount which was greater than it contained when newly cast, since a certain proportion of the zinc always volatilizes during the operation of brazing. In its deteriorated state this solder contained but 18 per cent. of zinc, and its porous condition is shown by the fact that its specific gravity had fallen from 8.24 to 7.45. Moreover, Professor Arnold discovered that even the remaining zinc no longer existed in the metallic form, but was completely oxidized. This oxidization, Professor Arnold thinks, was brought about by the action of fatty acids arising from the decomposition of the lubricating oils used in the cylinder by the high-pressure steam. These acids found their way from the cylinder to the condenser, thence to the boiler, and finally into the steam pipe, with the results just set forth. As against this, it has to be noted that Professor Arnold failed to effect saponification of a mineral oil stated to be similar to that said to be used on board the Prodano, even after exposure to a brisk current of steam for an hour, and this point seems in need of further elucidation. If the mineral oils now used as cylinder lubricants can be decomposed in this way and bring about such serious corrosion, quite new regulations as to the use of brazed seams will be required; but it is quite possible that through accident or inadvertence, vegetable or animal oils may have been employed on the Prodano.

With a view to avoiding such accidents in the future, the assessors at the Board of Trade inquiry made several recommendations, the most practical of which is the proposal to do away with copper pipes altogether and substitute iron or steel ones. The other suggestions made seem much less to the point, and in particular the court appear to have attached exaggerated weight to the value of hydraulic tests. In fact, they recommend that all copper steam pipes over 3½ inches in diameter, should be tested every four years, under an hydraulic pressure, straining the metal up to 2½ tons per square inch. Such tests are very often fallacious, and seem particularly so in the case of a pipe having a brazed seam. Were deterioration general some valuable information might, perhaps, be obtained by observing the deformation of

1. From *Engineering*, England.

the pipe under pressure, but, the wasting away being quite local, the total deformations will naturally be but little affected. In fact, the matter is very much on all fours with the dead load test of a bridge, where a weak bar may be dangerously overstrained without practically affecting the deflection of the bridge under test, or otherwise give evidence of its unfitness for its work. Indeed, a piece of the Prodano's pipe, in which the brazing was afterwards found by Professor Arnold to be seriously corroded, only burst when afterwards tested on the pressure reaching 890 pounds per square inch, or nearly six times the working pressure, which, in itself, shows the inconclusiveness of the proposed hydraulic test. Where copper pipes are used the court recommended that they should be wrapped with wire. That safety can be secured in this way is not open to doubt, since our heavy guns as now manufactured owe the major portion of their strength to wire wrapping; but theory shows and experiment has confirmed it, that to be effective such wrapping should be close. Lloyd's Committee do not appear favorable to this method of reinforcing pipes, though in their report on the Prodano explosion they have refrained from formulating their objections in detail, simply stating that in most of the explosions recorded little or no benefit would have been gained had the pipes been wire wound. So far as these failures have been due to insufficient provision for expansion, this view is probably well based; but the seriousness of the Prodano accident would certainly have been greatly diminished had the steam pipes been thus strengthened.

The Board of Trade Assessors further recommended the thorough examination and inspection of steam pipes at comparatively short intervals; and such inspections, where the conditions are at all favorable, certainly give much more information as to the safety of a structure than any hydraulic test. Unfortunately, however, the deterioration of the brazing, which was responsible for the Prodano disaster, occurs mainly at the interior of the pipe, the outside of the seam being comparatively little affected; this being more especially the case when the pipe is covered with lagging, which prevents the access of corrosive agents to the outer side of the joint. The difficulties of satisfactorily inspecting the interior of a main steam pipe are obvious, and in most cases would seem insuperable.

For stationary engines we many years ago used wrought iron riveted main steam pipes, which have given great satisfaction; but, as already pointed out, there is usually in these cases ample space to get in a long pipe with a couple of right-angle bends, which easily provide the expansion. On board ship space is more cramped, and hence expansion joints may be adopted if steel or iron pipes are used. For experimental work, the very ingenious flexible metallic tubing introduced some years since has been proved a great convenience, enabling an engine to be erected on the testing bed with an expenditure of a minimum of time and trouble. Such tubing has been used in this way for quite high steam pressures, though it is no doubt possible it might prove less satisfactory as a permanent fixture. There is, however, no fear of its being injured by expansion strains, which appear responsible for most of the steam pipe accidents.

[Translated for the JOURNAL by Mr. Herman Poole, F.C.S.]

Testing Packages for Liquefied or Compressed Gases.[1]

In a previous number we analyzed the new regulations established for the transportation, in France, of dangerous materials and infected substances. Ministerial instructions have completed these regulations, as far as concerns compressed gases, the carriage and care of explosives, etc.; and the rules prescribed for the conditions imposed on the tests of packages containing compressed gases are here placed before our readers.

These tests, as well as the verification of the statements regarding the weight of the package empty, and when carrying, as at times, its maximum charge, belong normally to the ordinary mine staff, the same way as with the tests of steam boilers.

Still, for these tests and verifications different apparatus and methods are required from those used in station boiler tests. The usual mine service does not have the same efficient supervision over these compressed gas packages as it does over steam boilers. It is not, theoretically, called on to guarantee the enforcement of the regulation concerning these containers while in transport by rail, hence, primarily, their hydraulic testing or the verification of the weights, empty and fully charged, as marked, are never made, except on demand of an interested party. The mine service has acted in no other cases.

It cannot now renew the tests made previously when a demand is made for a new test. On the other hand, the engineer or his assistant can make no examinations of the packages, but those which are necessary to confirm the marks stamped on them and to give the necessary data required. In such case, then, he will be obliged to make sometimes hydraulic tests only; sometimes, verifications of the marks as to empty and full weight, and at other times tests covering both kinds of determinations. Still he will not be required to know whether the apparatus is generally satisfactory for the other conditions which may exist in transportation by rail.

The hydraulic test taken by itself is always made under the same conditions, except variations in water pressure, depending on the destination of the package. This test is made cold. The container should be exactly filled with water. All the parts and all the connections which are under pressure should be in place correctly and should be tested; a temporary cock may replace a permanent one, if the closing is the same as would be had normally.

No leak is allowed, not even the slightest oozing. The engineer or his assistant carefully examines the apparatus after the test on the entire exterior surface, which should be entirely exposed to view, so as to assure himself that this portion shows no trace of a fault nor crack. Furthermore, he takes measures before and after the test, guiding himself by mould and joint marks, in order to be sure no permanent deformation of the package has occurred.

When the pressure is 25 atmospheres or less, it is determined by means of a verifying manometer, such as is furnished the agents of the mine service for the examination and testing of steam boilers. Hence, the apparatus furnished by the complainant consists of a fitting having a flange 0.04 m. (1.57 inches) diameter and 5 m.m. (0.2 inch) thick, arranged to receive the manometer.

When the pressure exceeds 25 atmospheres it is tested by means of a high pressure manometer. To receive this the complainant must furnish the necessary fittings, which are necessarily more complicated and expensive than those mentioned above.

Pressures.—The hydraulic tests are divided into three kinds, according to how they are made.

The first is that of the tests in which the pressure is numerically fixed by the regulation, under the following conditions:

Carbonic acid, liquefied Nitrous oxide, liquefied Acetylene, liquefied Acetylene, compressed to more than 1 atmosphere	250 atmospheres.	
Ammonia, liquefied	100	"
Chlorine, liquefied	50	"
Sulphurous acid, liquefied Phosgene ($COCl_2$)	30	"

For other gases, the test pressure depends on the maximum pressure, variable at the will of the complainant.

If this pressure, which in no case can exceed 200 atmospheres, is above 15 atmospheres the pressure of the test is equal to said pressure, plus one half. If the maximum pressure is equal to 15 atmospheres or less, the testing pressure is the maximum pressure increased by 4 atmospheres.

Original Tests and Re-trials.—No difference is allowable between the first test and the re-testing, as far as the hydraulic pressure is concerned.

To satisfy the requirements of transportation by rail, the re trials should succeed the first tests and be repeated at fixed intervals, according to the nature of the product, as follows:

For liquefied chlorine, liquefied sulphurous acid and liquefied phosgene, one year interval.

For liquefied carbonic acid, liquefied nitrous oxide, liquefied acetylene, or acetylene compressed to more than one atmosphere, liquefied ammonia, and all gases under pressure or more than 15 atmospheres, three years' interval.

Marks and Stamps.—In order to receive a package for the first hydraulic test, it must carry a mark distinctive of the maker, or, in default, of the proprietor and a number of a distinctive nature. Further, it must carry a stamped medal, fastened by at least two rivets. This may be an engraved tag, or it may be struck on the medal. This medal carries in the center a field on which is marked in *kilogrammes par centimetre* square (atmospheres pressure), either the pressure of the preceding test, with the prefixed abbreviation, E, if of the first class (test with pressure determined by the nature of the product), or the maximum pressure under which it is allowed to carry the gas found in the container; if the test is of the second or third class (tests with proportional or fixed excess pressure). Below this inscription is the place reserved for the date of the first test. After the test has been successfully

1. From *Revue Industrielle.*

made, the date is inscribed in the reserved place by a blow, and the agent making the test places the stamp of the government, either on one of the fastening rivets, if it be a medal; or, if it be a tag, he places it on both sides of the inscription showing the proof pressure and the service pressure.

For a retrial, the date of the test is simply inscribed by a punch on the apparatus, and at the left of this inscription the engineer or his assistant affixes the government stamp. This simplified method presupposes that the vessel carries, plainly visible, a stamp of the first test in France and the corresponding pressure.

Instead of presenting the vessel for retesting in the condition cited above, it is allowable for the interested party to furnish it with a new stamped medal, after having removed the old one. In this case, the result of the hydraulic test is stamped on the rivets, and the date on the new medal.

In all cases the setting or renewal of the stamped medal on the execution of the tag, except the marks necessary, shall be made by the complainant, who has also furnished all the appliances needed except the manometer.

Verification of Tare and Maximum Charge.—When the container is presented for verification and stamping of its weight empty, and with the maximum charge either conjointly with a first test or re-test by the hydraulic pressure, or separate from those tests, it is necessary that the package shall have, besides the medal or tag, an inscription showing the nature of the liquefied or compressed gas which it is destined to contain, and the abbreviations Ta. and Ch. to be followed by numbers showing the tare and the maximum charge. These abbreviations may be inscribed either on a medal fixed by at least two rivets, or engraved or stamped on the metal itself. Further, if the package is a container of carbonic acid, nitrous oxide, or acetylene, intended for exportation to the countries agreeing to the Convention of Berne, October 14, 1890, the number of the package shall be reproduced on its head or cover.

At the beginning of each day intended for the verifications of this kind, the party asking them sends to the engineer or his assistant a list of containers he will present, on which is stated, for each package, its maker's or proprietor's mark, and the distinctive number; also, the weight of the package when empty, including cock, but without cover or box; the weight of the same apparatus completely filled with cold water; the capacity deduced from the preceding data; the maximum charge resulting from the capacity, calculated and referred to the following volumes of one kilogramme of gas liquefied or compressed should occupy:

Liquid carbonic acid or liquid nitrous oxide	1.34*
Liquid acetylene or acetylene under more than one atmosphere pressure.....	1.34*
Liquid ammonia.....	1.86*
Liquid chlorine.....	0.90*
Anhydrous sulphurous acid and phosgene..	0.80*

[*Per pound, respectively, these equal: 37; 37; 51.5; 24.9; 22.1 cubic inches.]

And, finally, the statement must include the weight of the hood or box containing it, if it is to be used for liquid carbonic acid, liquid nitrous oxide, or acetylene, and destined for exportation to a country signing the Convention of Berne, October 14, 1890.

A column of observations will allow the agent to show which apparatus has been verified. On this list the weights are expressed in kilogrammes and fractions of a kilogramme, the volumes in liters and fractions of the liter, the whole following the decimal system, and with an approximation such that the weight may be expressed to the nearest thousandth of the total weight of the package when filled.

It must be understood that a package cannot be presented for verifications of the nature required unless it is provided with its own cock and generally with all the accessories which would be used for transportation by rail (always excepting the hood or box, which need not be presented except in certain cases.)

If the packages submitted for testing in question on a certain day, and of which the list has been sent to the agent as mentioned above, are equal to or less than ten, then the agent will proceed to test and verify each package and part separately in every particular. If the number exceeds ten, he may proceed to verify only a certain number of pieces, arbitrarily chosen by him from the whole lot. This number shall be at least 10, when the total number does not exceed 50; and beyond that number it must be increased at least 5 for every 50 or fraction of 50.

Possessed of the list mentioned, at the beginning of each day the agent takes out the packages described in the list and designates which ones are to be tested under his supervision. He determines also in what order the packages designated shall be submitted to verification. Each of these packages is then submitted, under his direction, to the three following tests: The package is weighed empty; it is weighed filled with cold water; the hood when present is weighed separate.

The agent satisfies himself that the results of the weighings agree exactly with the declared weights, and checks the calculations which, based on these facts, determine the maximum charge of the container.

For each package, if the declarations in the list are found correct, he marks in the middle of the figures:

1. At the right of the abbreviation *Ta.*, the weight of the container empty, and without hood, followed by the sign +. If he has room after the sign + he puts the weight of the hood. In all cases the sign + must be stamped after the weight empty, and without hood, even if such sign be not followed by the weight of the hood, so that he may prevent confusion caused by confounding the weight empty and without hood, and a number which may express the weight empty, and including hood.

2. At the right of the abbreviation *Ch.* shall be placed the maximum weight of the liquefied gas that is allowed to be forced in.

These indications must be stamped. To do so the agent making them affixes the government stamp:

1. If it carries a struck medal, once on each of the fastening rivets, and once beside the rivets on the medal.

2. If the abbreviations *Ta.* and *Ch.* are on the same medal, twice at the left of each indication.

This double stamping is to show that the indications of tare and maximum charge, which are also stamped on, result from weights actually verified by the agent by causing them made under his own inspection.

Finally, the agent who has made the verifications affixes the government stamp to the number inscribed on the hood or box, so as to prevent replacing this hood or box by another which might have the same number but a different weight. In case the verifications of weights, thus made for containers selected from a lot, agree perfectly with the declared weights, according to the furnished list, the results of weight inscribed on the list for the rest of the lot may be considered correct. Consequently, for the other packages the government agent may confine himself to the calculations which, based on the results as declared, determine the maximum charge of each container. When these calculations shall have been found correct, he will proceed to the inscriptions at the right of the abbreviations *Ta.* and *Ch.*, as mentioned above, and that done the mark of the government will be put:

1. If on a struck medal, once on each fastening rivet and not repeated on the side.

2. If the abbreviations *Ta.* and *Ch.* are on the metal itself of the holder, one single time at the left of each mark.

This simple sealing is intended to show that the indications of tare and corresponding maximum charge do not result from weight actually made by the agent, but simply from the declarations of the party interested; declarations presumed correct, because one portion has been checked under the conditions imposed by the government agent. The agent affixes besides, in this case as in the other, the mark of the government stamp near the number of the hood.

It must be well understood that, when the operations for which one lot of packages has been presented by the party includes the hydraulic testing or re-testing and verification of tare and maximum charge, all the packages of the lot, without exception, shall be submitted to the hydraulic test. This applies to those for which the weights declared by the party may be presumed correct without direct verification, as described above, as well as to those for which the weights are revised under the agent's direction.

When dealing with a lot of more than ten packages, and the agent had ordered the testing of the weights of those he has selected, it may happen that he finds a variation between the result of a weight made under his supervision and the declarations of the owner marked on the list.

In this case, the package showing the difference receives no seal or stamp, and the work for the day, even that of making hydraulic tests, is immediately suspended. The part of the list corresponding to the packages is canceled; the agent retires and the operations can be resumed on another day, only at request of the interested party, and accompanied by a new list conforming to the rules previously given.

If a lot of only ten packages or less is to be tested, and all the weights and determinations of charges are to be completely re-made by the engineer or his assistant, the existence of a divergence in results would simply cause a rectification of the list.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, April 9th, 1898.

The Price of Gas in London.—An Official Inquiry Respecting Water Gas.—A New Welsbach Burner.

In February I noticed that the Gas Light and Coke Company, of London, had found an increase in their charge for gas to be necessary. They have now announced that it will be raised from the present price of 2s. 10d. to 3s. per 1,000 cubic feet. A writer in a popular magazine, while treating of the price of gas and its importance to the consumers, said that the value of even a trifling reduction in price might be gauged from the clamor that would result from a corresponding increase. Going on these lines, it follows that a reduction of 2d. would be a very great consideration. Unfortunately, the customers of the Gas Light and Coke Company are already smarting under the knowledge that they are paying considerably more than their neighbors on the south side of the Thames, who are supplied with gas by the South Metropolitan Gas Company at 2s. 3d. per 1,000 cubic feet, with a discount of 5 per cent. to large consumers, while immediately on the east of the district the Commercial Gas Company are selling at 2s. 6d. per 1,000 cubic feet. This difference is especially likely to attract attention on the boundary lines of the districts concerned. When customers on the left-hand side of a street are called upon to pay 3s. per 1,000 cubic feet, while the right-hand side is supplied for 2s. 6d., or 2s. 3d., all the skill and ability of a trained debater are required to convince the 3s. customers that everything is fair and square, and that they are simply the victims of unfortunate circumstances. They will have it that the extra 6d. or 9d. is a tangible asset, that is either squandered by bad management or appropriated as excessive profit. This announcement of a 2d. increase has served to fan the smouldering discontent into a fierce flame. Another unfortunate circumstance is that, until within the last few years, the difference in price between the three companies was not so marked as to excite attention, being only a matter of 2d. or 3d., and now people are asking the reason why there should be such a great increase in this difference. The man who is called upon to pay 3s. wants to know why he cannot be supplied for 2s. 3d., and persists in thinking that he is the victim either of incompetence or sharp practice. The other two companies have been officially approached with a view of ascertaining whether they have a similar increase on the board, and replies in the negative naturally suggest the question as to why—looking at the fact that prices of coals, the state of the residuals market, etc., are the same in each case—one company require a rise while the others do not. It also happens that the Gas Light and Coke Company have a bill before Parliament providing for the readjustment of their capital, and the public conclude that the object of this application is to obtain some advantage or other at their expense. In addition to this there is the spirited attack upon the management which was made by Mr. George Livesey at the last meeting of the shareholders, which of itself furnishes a weapon that can be used against the Company. So the Gas Light and Coke Company are likely to have lively times during the next few months.

The state of public feeling is evidenced by the resolutions passed at a meeting of delegates from the vestries and local district authorities within the area supplied by the Company. It was unanimously agreed that in the opinion of the meeting the time had arrived when a Board of Trade inquiry should be held respecting the past and present management of the Gas Light and Coke Company, their existing statutory rights, and the past results, financial and general, of the existing statutory sliding scale of price and dividend, with a view of putting an end to the existing anomaly whereby gas consumers on the north side of the Thames have to pay 3s. per 1,000 cubic feet as against 2s. 3d. charged on the south side. A resolution to the effect that as the conversion and consolidation of the Company's stocks, and the making of such new stocks into trustees' stocks under the bill now before Parliament, would enhance the Stock Exchange value of the Company's undertaking by a very large sum, the conference was of opinion that Parliament should refuse to pass the bill unless the Company make some substantial concession to the consumers in the form of a reduction in the price of gas. It was also agreed that every possible influence should be brought to bear upon the London County Council, to induce them to oppose the Gas Company's bill, and also with the local Parliamentary representatives, to the same end. And an opinion was expressed that meetings of gas consumers should be held in all the districts affected, to support the local authorities in the action they propose to take. The speeches in which these resolutions were proposed, seconded and supported, included some very plain language with a liberal proportion of adjectives and many uncomplimentary references to the affairs of the Gas Light and Coke Company. Mr. Geo. Livesey's speech as above referred to was quoted at length. And the whole tone showed a deep-seated feeling of discontent, that is something more than a mere passing ebullition, and that will have to be dealt with. This cannot be regarded as unexpected, for one of the greatest misfortunes that can befall a gas undertaking is to have a next-door neighbor who can sell gas at a substantially cheaper rate. As long as there is such a difference as 9d., or even 6d., per 1,000 cubic feet in the price of gas in various parts of London, there will be opposition and discontent of a more or less bitter character. And the fact will come conveniently to the hand of those who advocate municipal ownership of gas works. This feeling appears to be gaining ground in the metropolis, and the London County Council are moving in the direction of controlling not only gas works but everything else. So far I have not heard of any expression of opinion from the slot meter customers. These now form an important proportion of the whole, and will certainly, sooner or later, have something to say from their point of view.

Some months ago, while discussing the properties of carbureted water gas in relation to cases of accidental poisoning, as compared with coal gas, I remarked that apparently the Government had not, so far, considered any special action in the direction of protecting the public to be necessary. Now it appears that the question of leaving gas companies in the possession of full liberty to supply either sort of gas as they think desirable, or mixtures in any proportion, has come under the attention of the Secretary of State for the Home Department, who has appointed a special committee to investigate and report upon the subject. And he has further recommended that the granting of such powers by Parliament shall be held over until the inquiry is completed and the report presented, so that any recommendations which the committee may decide upon may receive due consideration. Alarmist reports have been raised from time to time as to the alleged poisonous properties of "water" gas—the distinction between that and carbureted water gas being usually ignored—but it is not probable that they have carried sufficient weight to influence the matter. Bearing in mind the rapid increase in the use of this system, which has led to a clause being included in all applications to Parliament on the part of gas companies, giving power to adopt it if desired, there is no occasion to search for the reasons that have led to the proposed inquiry. The Secretary of State would do wrong if he either expressly authorized or tacitly by sufferance allowed any new process to come into general operation, without obtaining the best possible technical advice upon the subject. The present inquiry means no more and no less. The committee have no power to compel the attendance of witnesses or the production of evidence. They will simply invite information, and there is every reason to believe that such will be cheerfully furnished by those who have had practical experience and are entitled to speak with some authority. The inquiry will not be confined to the supply of carbureted water gas as a substitute either partly or wholly for coal gas, but will include all processes for the decomposition of steam by contact with incandescent carbonaceous matter, with the production of a gas containing a considerable proportion of carbonic oxide, such as producer gas and various technical applications of gaseous fuel. It is to be hoped that the whole proceedings will be published in extenso, so that they may receive full criticism on all sides. Without saying a word against the necessary protection of the public, we may remark that a special committee carry great powers as regards the fortunes of the industry under investigation. The man who sneaks into a gunpowder magazine to have a quiet pipe, or who seeks to rouse a failing fire by libations from a quart bottle of benzoline, will always be with us. So will the public spirited individual, who urges with commendable, if mistaken, ardor, that the use of gunpowder or benzoline should be made an indictable offence. No legislation can prevent the consequences of ignorance or carelessness, and, therefore, important industries, giving employment to thousands of workmen, should not be at the mercy of a few excitable people, or loaded with prohibitive restrictions at the whim of one or two faddists, who reason from exceptional cases. These remarks can be made the more freely in the face of the fact that, judging from what has leaked out as to the constitution of the committee, the case of water gas will have a fair and impartial investigation, the results of which may be looked for with confidence by all interested in the subject, who may safely regard such a committee as their best friends.

About next midsummer we are to be prepared for a surprise in the shape of a substantial improvement on the Welsbach incandescent gas burner. The Chairman of the Welsbach Indandescent Light Company

in the course of his speech at the recent annual meeting of shareholders, said that they were about to put upon the market a burner that would yield a duty of 30 candles per cubic foot of gas consumed. The ordinary burners as at present in use require to be delicately adjusted as to pressure and rate of consumption. As those who have practical experience in applying them know well, for each burner there is one maximum point, and the conditions in these respects must keep in the neighborhood of that point if the full efficiency of the burner is to be maintained. With a higher pressure the effect is not so luminous, and with a lower one the light has a nasty flicker, and for these reasons the burner has frequently obtained a bad reputation in the hands of those who do not understand it. A good way of illustrating the importance of this point in the gas office is to put up a specimen on a high pressure service without a regulator, and a tap with a long lever handle. By means of the tap the effects of high and low pressure can be simply illustrated. But it must be "Caesar or nothing." There is no leaving the burner half on, or at a glimmer. The 50 or 60-candle light is all very well if the room is in use, but a 10-candle light would be sufficient if it is vacated for a time. The new burner not only gives a higher duty but is claimed to be capable of maintaining this degree of efficiency under such wide variations, that it is apparently independent of pressure or rate of consumption. Our authority says that whether the consumption is ½ cubic foot per hour or anything up to 10 cubic feet the duty per cubic foot of gas used is the same. If these advantages are to be realized without any disadvantage or objectionable feature, such as a ridiculously high price (similar to that which so hindered the introduction of the present burner) or a clumsy or ugly design of appliance that does not adopt itself nicely to existing fittings and shades, we shall certainly have an advance on the ordinary Welsbach of more importance than was presented by the introduction of that appliance as compared with the ordinary flat flame. One point, however, suggests itself. With a light equal to 15 candles obtained by a consumption of ½ cubic foot per hour, what becomes of the prospects of a larger consumption per consumer? This point need not be discussed very anxiously. There are always a certain number who will have as much light as they can get. They do not go into niceties of candle value and photometrical results, but they like a good light, and if the new burner gives twice as much as the old one, will still continue to turn it on full and use as much gas as they did before. The present burner shows great economy in particular cases as compared with flat flames. But I have not found that it spoils the general result. Where A saves half his gas, B puts on more burners, and C who did not previously use gas, hears such good accounts from A and B that he promptly has it laid on.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. U. G. PHETZING, of Lexington, Mo., has sold his interest (it amounted to control) in the Lexington Gas Company to the L. M. Rumsey Mfg. Company, of St. Louis.

THE Common Council, of Cohoes, N. Y., has awarded a contract for the lighting of Cohoes, by means of arc lamps, to the Cohoes Gas Light Company. The contract is to run for three years, a moontable is to be followed, and the rate is $75 per lamp per annum.

SECRETARY C. E. DAVENPORT, of the Troy (N.Y.) Gas Company, has formally notified the holders of the Company's registered debenture notes, of 1892, that the latter may be exchanged for second mortgage, coupon bonds, bearing interest at the rate of 6 per cent., principal payable in 1923. Holders desiring to make such exchange must forward their application and consents on or before May 1st.

AT the annual meeting of the Hempstead (L. I.) Gas Company the officers chosen were: Directors, Valentine Snedecker, George D. Smith, J. E. Davidson, J. L. Jenson, T. A. Carman, C. E. Gittens and Richard Ingraham; President, J. E. Davidson; Vice-President, J. L. Jenson; Secretary and Treasurer, C. F. Gittens; Superintendent, John Findlay.

AN inventory of the effects of the municipal gas plant of Hamilton, Ohio, recently filed by Superintendent Lorenz, goes to show that the last flood damaged the plant in the sum of $2,106.

A CORRESPONDENT at Dubuque, Iowa, writing under date of the 25th ult. says: "The Company at Le Mars, Iowa, has been reorganized, under the corporate name of the Le Mars Gas Company, with a capital of $22,000. The new officers are: Directors, I. S. Struble, W. G. Bolser and O. H. Hinds, of Le Mars; and J. L. Clough and C. W. Hoyt, of Nashua, N. H.; President, C. W. Hoyt; Vice-President, I. S. Struble; Treasurer, J. H. Clough; Secretary and Manager, O. H. Hinds. The offices of the Company are to be located at Main street, north of Seventh street, and it may be accepted as a certainty that the poverty of management which has hitherto been prominent in its direction will be succeeded by commonsense business practices that will enlist the practical support and sympathetic assistance of the community."

THE generating capacity of the plant at Rome, Ga., is to be doubled. The contracts for the betterments have been awarded, and work under the same has been commenced.

AT the annual meeting of the Princeton (N. J.) Gas Light Company the following Directors were chosen: Dr. J. H. Schanck and Messrs. J. H. Bruere, Edward Howe, Paul Tulane and J. E. Burke.

THE annual election of the Savannah (Ga.) Gas Light Company resulted as follows: Directors, J. H. M. Clinch, A. G. Guerard, Jacob Raners, Jno. C. Rowland, Wm. M. Low, H. H. Gilmer, T. M. Cunningham, J. F. Menis and A. R. Lawton, Jr.; President and Treasurer, A. G. Guerard. The only change shown in the returns is the replacing of Mr. John Nicholson, Jr., by Mr. T. M. Cunningham.

THESE figures (although belated) in connection with the operations of the Montreal (Can.) Gas Company, for the last year, are still of interest. During the year 11¼ miles of mains and services were laid, and 945 new services were put in. The works and plant of the Company were maintained in a high state of efficiency, and a number of changes and additions were made that the increasing business of the Company necessitated. In the year 2,024 meters were put on, of which 1,597 were of the prepayment type—this is the largest number of meters put in by the Company during any one year. In the twelvemonth, 858 gas stoves and 292 gas fires were placed. The Directors report that this branch of the Company's business was almost doubled, compared with the output on that account the previous year, and that the outlook is for a marked advance. The illuminating power and purity of the gas were maintained at grades well above those specified in the statutes. The contract for coal, which was made in 1893, having expired a new one (to cover a year) favorable to the Company was entered into. The Directors testify to the valuable services of the Secretary and the continued efficiency of the officers and clerks, who have discharged their several duties to the satisfaction of the Board. Two semi-annual dividends of 5 per cent. each were declared, and the profit and loss account shows a balance of $304,428 carried forward to next year. The balance brought forward from last year was $303,440, and the net revenue for the year was $333,947. The revenue account shows that sales of gas amounted to $596,634; and the total expenditure is returned at $376,465. The chief liabilities are: Capital stock, $2,997,916; bonds, $743,320. Principal assets: Gas works, mains and real estate, $3,929,001; meters in use and on hand, $157,358; accounts receivable, $110,981. The report was adopted with but little discussion. In reply to a question from Mr. John Crawford, President Holt said the Company had found it far more profitable to collect the accounts monthly instead of quarterly. He showed that in former years, under the quarterly payment system, the Company frequently lost $10,000 per annum in bad debts; while the bad debts by the monthly payment system only amounted to about $4,000 per annum. A proposition to cause the payment of dividends every three months instead of each six months was negatived. The Directors elected were: Messrs. H. S. Holt, Hugh McLennan, Robert Mackay, Hector Mackenzie and C. R. Hosmer.

THE *Chorister* is responsible for this: "Have you acolytes in your church?" inquired the Brooklyn girl of her country cousin. "My, no," was the reply. "We put in electric lights three years ago."

AN occasional correspondent sends the following: "I was recently in Akron, Ohio, and had occasion to visit the old Loomis fuel gas plant, long since shut down; and such a sight as it is to-day! The contrast between what was and what is was ever uppermost every step I took around the works. Ten years or so ago the Loomis process was vaunted from the housetops as the coming fuel, and the millennium of the householder and the manufacturer. The Akron plant was built amidst the blare of trumpets, and with the limelight turned full on. Life was to be made easy, factories thereabouts were to use this gas galore, and the greatest benefit to civilization in general was about to be demonstrated. To-day, what remains? A few old buildings, a hole

in the ground, and a lot of wrecked machinery. As everyone knows, the scheme proved an utter failure. The plant was shut down, and bit by bit it has been stripped. The purifying boxes have been removed and re-erected in the regular city illuminating gas plant. The large holder is just about to be finally removed; likewise, the small holder. One wanders around and finds but empty buildings, dust and rust. Slime and caving walls and broken pipes mark the site of the old holder; in one corner is the wreck of an experimental fuel gas furnace, and in the generator house ruin and desolation are pictured to a degree. Two of the old generators have been removed; two others are stripped and broken and shattered. Shells are lying around in confusion, and a medley of old exhausters, floor plates and beams, broken windows and pitholes in the floor intensifies the picture and the contrast between the conquering promise of the plant at its beginning and the utter chaos of this wreck, its end. Without are more drip holes, and traps full of slime and weeds and rats. In the daytime even the sparrows flit and chatter contemptuously through the works; at night time it is but a retreat for wailing cats and nomadic citizens. The contrast between the past and the promises of the beginning and the cold facts of the present and the end, is positively impressive. If any gas company is threatened by a prospective Loomis fuel gas enterprise all it need do is to photograph the present Akron remnant. Such a picture would convert even the most obdurate council from the beauties of blue or fuel gas. As a matter of record, of history, of ammunition, it would pay the legitimate gas companies of the country to secure a good set of photographs of the Akron fuel gas fizzle as it stands to-day—as great a wreck physically as the scheme was financially from the beginning."

THE proprietors of the Carlisle (Pa.) Gas and Water Company have declared a dividend of 3 per cent.

AT the annual meeting of the Rochester (N. Y.) Gas and Electric Company the following Directors were chosen: J. Lee Judson, William Runkle, Frederick Cook, Geo. W. Archer, A. H. Harris, Granger A. Hollister, Walter S. Johnson, H. G. Runkle, R. A. C. Smith, Geo. C. Hollister, Harry L. Brewster, John N. Buckley and George A. Redman.

MR. N. M. HARRIS, Secretary and Manager of the Urbana and Champaign (Ills.) Railway, Gas and Electric Company, has arranged for a series of eight lectures on cooking by gas, the lectures to be held on the 4th of this month, one each afternoon, and two during the evening—probably the latter will be given the evenings of Wednesday, May 25, and Saturday, May 28. The demonstrator will be Mrs. Sarah Tyson Rorer. It is proposed to issue season tickets for the complete course, the charge therefor to be $1. Presumably, admission to any single lecture will be 25 cents. Over 300 gas ranges are now in use in Champaign and Urbana, of which 200 have been installed since 1896.

MENTION of Champaign and Urbana might be further made in the statement that the Company will this season construct a 50,000 cubic foot holder, and will also put in about 4 miles of 4-inch mains.

THE Boston *Transcript* says that the Board of Gas and Electric Light Commissioners recently authorized the Woburn Light, Heat and Power Company to increase its capital stock by $110,000, and its bonds by $175,000. Of the bonds $85,000 are to take up an existing bond issue now coming due, and the balance, with the new stock, will be devoted to the erection and equipment of a new station. In view of the large loss involved in the abandonment of the old station, the Company, at the suggestion of the Commissioners, has cancelled $35,000 of its original capital stock, so that the increase in stock and bonds is $165,000.

THE proprietors of the American Gas Company, through Manager Farwell, of its Waukesha (Wis.) plant, have promulgated the following rate schedule for Waukesha—it took effect yesterday: Gross, $1.80 per 1,000 cubic feet, prompt payment entitling the user to the following discounts: Under 1,000 cubic feet per month, 10 cents; 1,000 to 2,000, 20 cents per 1,000; over 3,000, 30 cents per 1,000; fuel gas, $1.40 per 1,000.

MR. ALBERT RIETMEYER, formerly connected with the Bayonne and Greenville (N. J.) Gas Light Company, has been appointed Superintendent of the Perth Amboy (N. J.) Gas Company, succeeding Mr. J. C. Ross, who, as we noted before, has been appointed Superintendent of the American Gas Company's plant at Rye and Portchester, N.Y.

THE City Assessors of Detroit, Mich., have revised the rating of the Detroit City Gas Company, on account of assessing its personal property. The rating was originally put at $4,000,000; under the revision the rating is $1,287,880.

AN application has been made to the authorities of Butte County, California, by the projectors of the Gridley Electric Light Company, for a franchise, for a term of 50 years, "to lay gas pipe in the town of Gridley * * * to serve as conduits for electric wires, or gas."

AT the annual meeting of the Painesville (Ohio) Gas Light and Coal Company the officers chosen were: Directors, J. W. Alexander, S. Burridge, S. R. King, C. H. Frank and George P. Steele; President and Treasurer, Geo. P. Steele; Vice-President, S. R. King; Secretary, S. Burridge.

THE Newark (N. J.) *Call*, of recent date, said: "Two years ago a majority of the stockholders of the Newark Gas Company entered into an agreement, placing their stock in the hands of three Trustees of the Board of Directors, authorizing them to vote the stock and to otherwise use it for the interests of the whole number. The proviso was made that the stock should not in any case be sold at a lower price than 120. As it was then quoted at much less in the markets, the price was considered a liberal one, and probably all of the stockholders would have gladly reaped the profit then. The agreement has about expired, and a few days ago new proxies were issued for another agreement. It is on the same basis as the other and grants large powers to the Trustees; but instead of the selling price being fixed at $120 as a minimum, the agreement provides that there shall be no sale for less than $300. It is not known that a sale of the majority interest is in prospect, though the old rumors are frequently revived. The price fixed is not far above that paid for small holdings of the stock at comparatively recent dates."

THE stockholders of the Consolidated Gas Company, of Pittsburg, Pa., have assented to the plan which proposes to increase the common stock from $300,000 to $4,000,000, and to create a bonded debt of $5,000,000. This settles the consolidation of the gas interests of Pittsburg and Allegheny, and eventually means that a new modern plant, up to supplying all the gas needed in both cities, will be constructed on the site occupied by the old Pittsburg Gas Company. The formal ratification of the amalgamation will be made on the 11th inst.

The Electricity Supply of London.

On April 5th last Mr. Arthur H. Preece, C.E., read before the Institute of Civil Engineers, London, England, a paper on the manner and method in vogue of supplying electric currents in London. In the course of his presentation, Mr. Preece remarked:

The supply of electricity on a commercial scale had been started in London after the passing of the Act of Parliament in 1888 which amended the Act of 1882, principally by extending the date for compulsory sale to the local authority from 21 years to 42 years. In 1888 many companies applied for Provisional Orders, and, in determining which were to be granted powers, and the districts over which the powers were to extend, the Board of Trade decided that competition would be advantageous to the public, and that it was advisable to allow one direct-current system to compete with one alternating-current system.

There were now in London eleven important companies and five vestries supplying electricity, and three other companies and three vestries were taking steps to start works. The capital invested in the industry amounted to £6,000,000, and plant was installed to the extent of 80,000-horse power, the equivalent of 2,000,000 eight-candle power lamps being connected to the mains. The total annual revenue was £800,000, and the total annual expenditure £450,000.

Of the systems for supplying electricity in London, the alternating current was applicable to large areas where consumers were scattered, and it enabled the generating works to be established by the river side, or where land was cheap and coal was easily unloaded. The undertakings using this system were the City of London Company, the Metropolitan Company, the London Electric Corporation, the County of London Company, House to House Company, Hampstead Vestry, Islington Vestry and Hammersmith Vestry. The direct current systems were divisible into two classes, the high pressure and the low pressure. In the former rotary transformers were used to reduce the high pressure to a low pressure, while the latter produced and distributed electricity at the same pressure at which it was supplied to consumers. The direct-current systems were applicable to compact areas, and, with the use of high pressure, to scattered or isolated compact areas. The chief advantages of the direct-current system were the

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possibility of using storage batteries, which could not be employed with the alternating current systems, greater efficiency in distribution and greater adaptability to motive power. The undertakings using the system were the Chelsea Company (high pressure), Charing Cross and Strand Corporation (high pressure), the Westminster Corporation, the St. James' and Pall Mall Company, the Kensington and Knightsbridge Company, the Notting Hill Company, the St. Pancras Vestry and the Metropolitan Company (at one works.)

The generating works of the several undertakings in London contained many interesting features. No less than 20 different works have been erected. The boilers used comprised the water tube, marine, Lancashire, and miscellaneous types; but the preference for the water tube boiler was very marked. The works were liable to sudden demands through fogs, and the quick steaming properties of this type of boiler were of great advantage. The boilers were fired chiefly by hand with Welsh coal, but in the works of the City of London Company and the County of London Company mechanical stokers and cheaper coal were used. The use of extensive systems of steam pipes was now being dispensed with. The multiplicity of valves was unnecessary, and the number of valves was being reduced, and arrangements were made as simple and with as few joints as possible.

The present tendency was towards engines of the marine type for large outputs. The high-speed engine was not used for larger powers than 750-horse power. Some engineers, however, found engines of 350-horse power sufficiently large and the most convenient unit to adopt. The dynamos were similar in most works, and were always connected direct to the engines. Storage by secondary batteries was not extensively employed in London, as their maintenance had hitherto proved expensive. But a few works used them entirely for maintaining the supply after midnight, and in the daytime in summer. The author gave the results of a test of a small marine engine and alternator, showing the combined efficiency to be 85.5 per cent. The question of vibration had been of great importance in many works; no cure had been found effective when once vibrations were set up. High-speed engines must have three cranks to be free from appreciable vibration.

The favorite methods of distributing electricity were to transmit current at a high pressure in heavily insulated cables in iron pipes, and current at a low pressure in insulated cable in stoneware conduits or in cables heavily armored and laid direct in the ground. Rubber was now little used, paper and jute, impregnated with insulating compounds, having been extensively adopted.

The industry was growing so rapidly that most undertakings had to seek new sites for generating works, and the tendency was to erect large works on the outskirts of London, where coal could be conveniently brought to the site, and where water could be obtained for condensing. The powers granted under Provisional Orders were limited as regards the compulsory purchase of land, and further powers were being sought by some companies from Parliament, so that they might be placed on the same footing as railway companies. No less than 40,000-horse power is now being installed in London in order to meet the demand for electricity in the immediate future.

Oil Fuel Displaced for Cause.

Engineering Record reports that the use of oil fuel has been abandoned at the Detroit water works, on account of the increase in its cost. In the annual report for 1897 of Mr. L. N. Case, general superintendent of the department, it is stated that hard coal, costing from $4.17 to $4.50 a ton, was used during many years, for it was thought no other fuel could be burned because of the close proximity of the pumping station to the settling basin. In 1892 crude oil was introduced and resulted in a considerable saving so long as it price remained at about 1.5 cents a gallon. By the fall of 1895, however, the price had risen to 2.18 cents, and it was decided to use soft coal, with smoke-preventing attachments to the furnaces. In the meantime tests were made with so-called smokeless coals, which were found to be so near that condition as to warrant the belief they could be used without material injury to the water in the basin. In the report of Mr. Uriah Gould, chief engineer of the pumping works, it is stated that Pocahontas coal gave an average station duty of over 100,000,000 foot-pounds per 100 pounds, while the soft coal gave only 85,000,000 foot-pounds; the former cost $2.63½ and the latter $2.37 a ton, but the greater evaporation power of the former made it a slightly better investment. It should be said, in passing, that the reports of these officers and that of Mr. G. S. Williams, civil engineer of the works, are full of interest to water works officials.

The Market for Gas Securities.

The speculators seem to have determined that the war now on with Spain will not be fraught with serious results to this country, and in consequence the last two or three days witnessed a stock market every indication of which favored those who operate on the long side. Earlier in the week Consolidated sold down to 170½, but at noon to-day (Friday) sales had been made at 174½. A considerable short interest is said to exist in Consolidated, but regarding such statement we have little faith. The Company's business in the instance of output on fuel account is increasing in a really remarkable way, the sales and rentings of ranges each month going well into the hundreds. And the latter news also counts, in somewhat lesser degree, with the other local companies. The administration of the affairs of the New Amsterdam Company is fast assuming well-drawn lines; and, putting all the signs together, the conclusion is sound that, at the quoted prices, every city gas stock is cheap. Standard common, at 123 to 130, is undeniably tempting. A notable thing about the recent slump is that the quotations were cut on a remarkably small number of bona fide transactions.

In out-of-town shares a generally better feeling prevails, notably in the instance of Peoples, of Chicago, and Brooklyn Union. The former opened to-day at 90¾ bid, and the latter was 111 bid. The Directors of the Peoples Company have declared a regular quarterly dividend of 1¼ per cent., payable May 25th. Buffalo City gas is somewhat lower than a week ago, and Detroit gas is notably lower. Laclede shows no change of moment. Consolidated, of Baltimore, is steady, at 58 to 58¼. We repeat our suggestion of some time ago that these shares should cross 70 before the upward movement in them culminates. Our item columns contain something of interest to those concerned in the gas properties in and about Newark, N. J.; and rumor has it that the Montclair and Bloomfield gas properties have changed hands. The consolidation at Pittsburgh, Pa., is to all intent and purpose accomplished. The general situation is amazingly strong, our reports of sendout for January, February and March, 1898, as compared with the returns for the corresponding months in 1897, showing an average gain of 11.4 per cent.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

MAY 2.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$36,230,000	100	174	175
Central	500,000	50		..
" Scrip	220,000	..	100	.
Cental Union, Bonds, 5's	3,000,000	1,000	99½	100
Equitable	4,000,000	100	206	215
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	,500,000	100	280	290
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
New Amsterdam Gas Co.	13,000,000	100	23½	25
Preferred	10,000,000	100	62	63
Bonds, 5's	11,000,000	1,000	90	93
Northern	150,000	50	..	
" Bonds	150,000	1,000	..	
Northern Union, Bonds, 5's	1,250,000	1,000	94½	95½
New York and East River	5,000,000	100	81	83
Preferred	2,000,000	100	112	115
Bonds 1st 5's	3,500,000	1,000	108	111
" 1st Con. 5's	1,500,000	..	104	106

Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	128	130
Preferred	5,000,000	100	140	150
Bonds, 1st Mortgage, 5's	1,500,000	1,000	114	115
Yonkers	200,000	50	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	113	..
" " Bonds (5's)	15,000,000	1,000	110	..
Bay State	50,000,000	50	2¾	3
" Income Bonds	2,000,000	1,000	..	75
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	89	90
2d " " "	3,000,000	1,000	..	70
Buffalo City Gas Co.	7,000,000	100	24½	25
" " Bonds, 5's	7,000,000	1,000	90	92
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,069,000	.	89	91
1st Mortgage	1,085,000	..	101	103½
Consumers. Jersey City	2,000,000	100	75	80
" Bonds	600,000	1,000	102½	105
Cincinnati G. & C. Co.	8,500,000	100	194¾	..
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	11,000,000	100	58	58¼
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit	4,000,000		48	51
" Con. Bonds	4,312,000	..	..	95
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	78	81
" Bonds	2,000,000	..	89	91
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	115	125
" Bonds, 6's	2 650,000	..	106	107
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	78	83
Bonds	1,000,000	1,000	90	91
Louisville	2,370,000	50	..	..
Laclede, St. Louis	7,500,000	100	41	41½
Preferred	2,500,000	100	85	..
Bonds	9,034,400	1,000	100	101
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	200	220
Bonds, 6's	4,000,000	..	128	130x
New Haven	1,000,000	25	252	..
Oakland, Cal.	2,000,000	..	53½	54
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	90¾	91¼
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000		87½	90
San Francisco, Cal.	10,000,000	100	94	94½
St. Paul Gas Light Co.	1,500,000	100	49	51
1st Mortgage 6's	650,000	..	84	87
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	2,500,000	25	17	19
Bonds	1,000 000		94	97
Washington, D. C	2,000,000	20	220	..
Western, Milwaukee	4,000,000	100	77	78¼
Bonds, 5's	3,556,000	..	102½	103½
Wilmington, Del.	550,000	50	200	

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Two Coolers, or Air Condensers, each of 150'000 cubic feet capacity.

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The undersigned, as Receiver, will, on Tuesday, the 31st day of May, A.D. 1898, at the north door of the Court House, in Girard, Crawford County, Kansas, offer for sale to the highest bidder for cash at time of sale, the gas and electric light plants of the Pittsburg Gas Light and Coke Company, of Pittsburg, Kansas, which comprises one-half block in the center of the city, with the improvements and machinery thereon, and the gas and electric light systems of the city of Pittsburg. The Pittsburg Gas Light and Coke Company is a Kansas corporation with a capital stock of $100,000. The property will be sold subject to outstanding bonds in the sum of $52,500, and for not less than sufficient to pay outstanding Receiver's certificates and expenses, and costs, which at the time of sale will approximate $13,000. The gross yearly income from the plants averaged $19,000 for the past two years, and improvements to the amount of $10,000 have been added to the property during that time. The Gas Company has a lighting contract with the city that has yet 10 years to run, that pays about $5,000 per year. Pittsburg, Kansas, in March, 1897, had a population of over 12,000. It has since increased. It is in the center of the coal and zinc region of Southeastern Kansas, and is the most progressive and thrifty city in the State. During the year ending March, 1897, the population increased upward of 2,000. The property is desirable for any one seeking that kind of investment. For further particulars address the undersigned,

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in a Southern city of 3,800 inhabitants.

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at a bargain,

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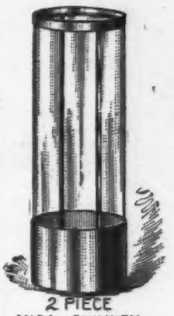

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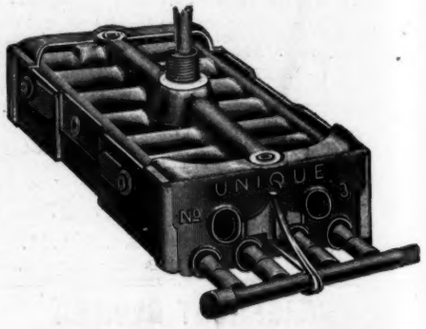
The Unique Water Heater—Can be attached to any size Boiler.

A device not expensive, not complicated, yet durable and practical. It occupies no space valuable for other purposes, as it is placed directly under the boiler and between the arms of the stand, and works like a charm.

No. 3. List $10. Will heat a 30 to 40-gallon boiler under ordinary conditions in less than one hour, ready for bath. **No. 4. List $16.** Will heat a 40 to 60-gallon boiler under ordinary conditions in less than one hour ready for bath.

Gas appliances of all kinds. Keep our Catalogue on file.



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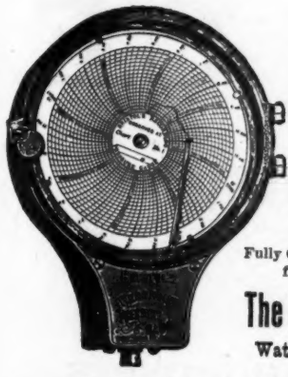

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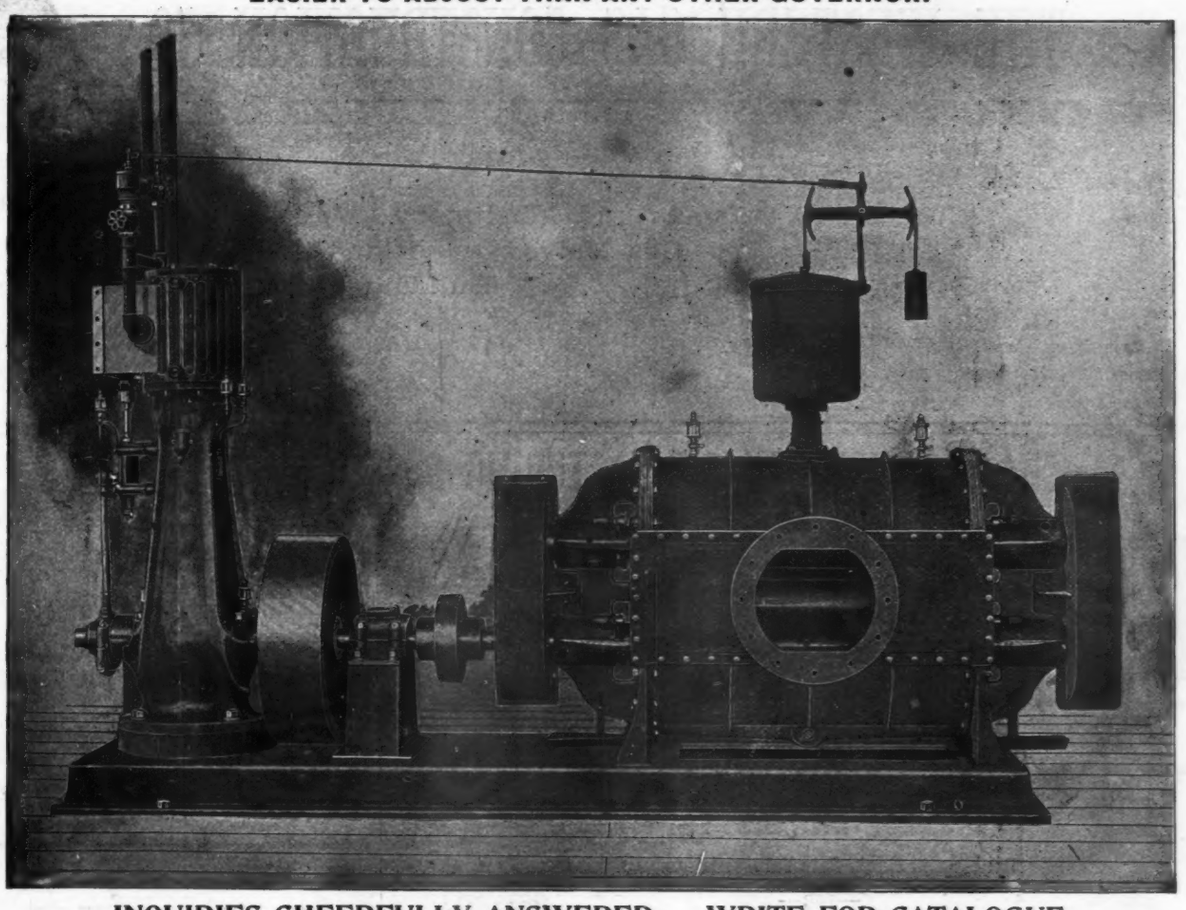

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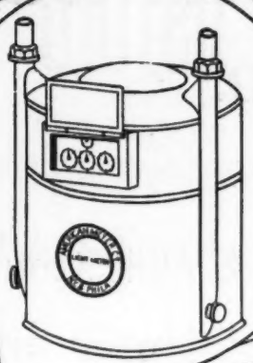
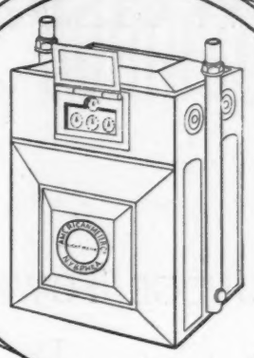
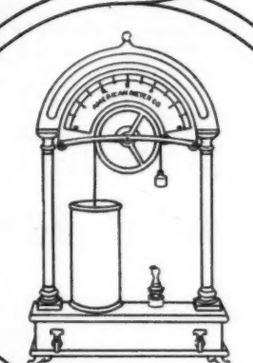


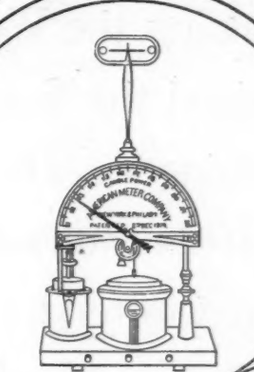


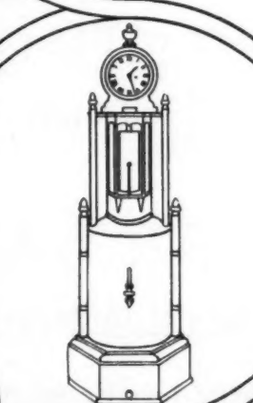
PUBLIC LIGHTING TABLE.

MAY, 1898.

Day of Week.	Table No. 1. Following the Moon.			Table No. 2. New York City. All Night Lighting.	
	Date.	Light.	Extinguish.	Light.	Extinguish.
				P.M.	A.M.
Sun.	1	1.30 AM	4.00 AM	6.45	4.00
Mon.	2	2.00	4.00	6.45	4.00
Tue.	3	2.30	4.00	6.45	4.00
Wed.	4	No L.	No L.	6.45	4.00
Thu.	5	No L. FM	No L.	6.45	4.00
Fri.	6	No L.	No L.	6.45	4.00
Sat.	7	7.30 PM	10.10 PM	6.55	3.40
Sun.	8	7.30	11.20	6.55	3.40
Mon.	9	7.30	12.10 AM	6.55	3.40
Tue.	10	7.30	12.50	6.55	3.40
Wed.	11	7.30	1.30	6.55	3.40
Thu.	12	7.30 LQ	2.00	6.55	3.40
Fri.	13	7.30	2.30	6.55	3.40
Sat.	14	7.30	2.50	7.00	3.30
Sun.	15	7.40	3.10	7.00	3.30
Mon.	16	7.40	3.40	7.00	3.30
Tue.	17	7.40	3.40	7.00	3.30
Wed.	18	7.40	3.40	7.00	3.30
Thu.	19	7.40	3.40	7.00	3.30
Fri.	20	7.40 NM	3.40	7.00	3.30
Sat.	21	7.40	3.40	7.10	3.15
Sun.	22	7.50	3.40	7.10	3.15
Mon.	23	7.50	3.40	7.10	3.15
Tue.	24	7.50	3.40	7.10	3.15
Wed.	25	10.20	3.40	7.10	3.15
Thu.	26	10.40	3.40	7.10	3.15
Fri.	27	11.10	3.40	7.10	3.15
Sat.	28	11.30 FQ	3.40	7.15	3.15
Sun.	29	12.00	3.30	7.15	3.15
Mon.	30	12.20 AM	3.30	7.15	3.15
Tue.	31	12.50	3.30	7.15	3.15

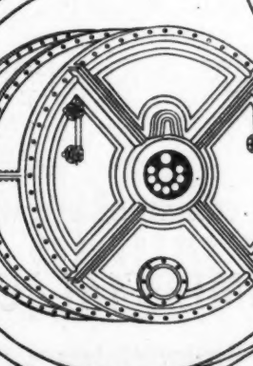


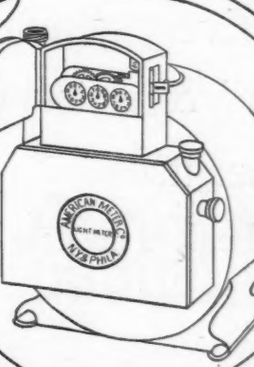




TOTAL HOURS LIGHTING DURING 1898.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	210.40	January	423.20
February	186.40	February	355.25
March	181.20	March	355.35
April	166.10	April	298.50
May	156.40	May	264.50
June	144.30	June	234.25
July	147.30	July	243.45
August	157.10	August	280.25
September	169.50	September	321.15
October	186.00	October	374.30
November	204.30	November	401.40
December	218.30	December	433.45
Total, yr.	2129.30	Total, yr.	3987.45





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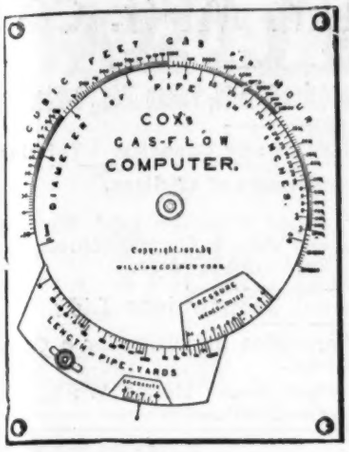

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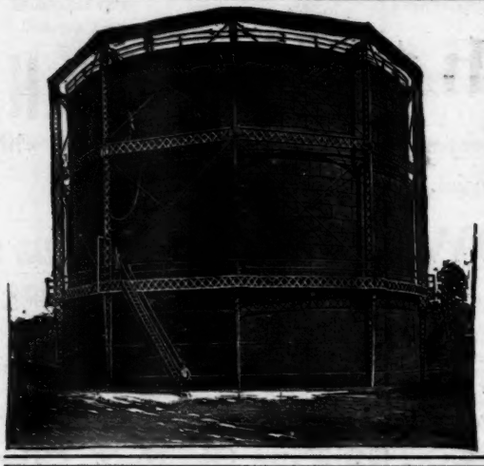

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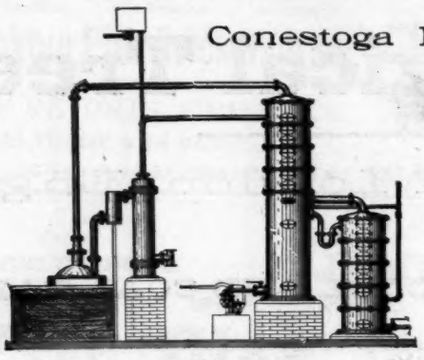

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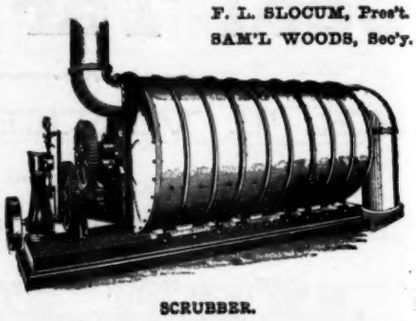

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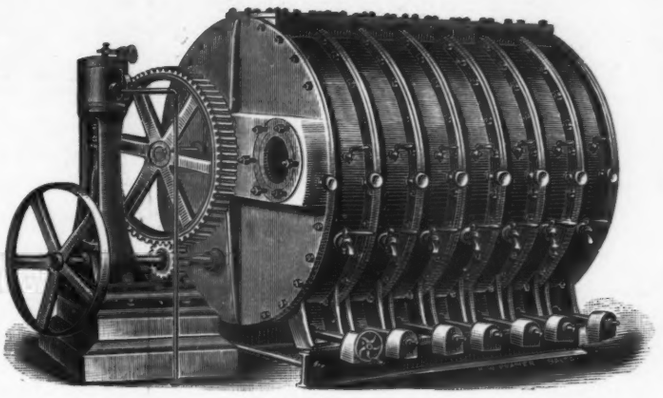

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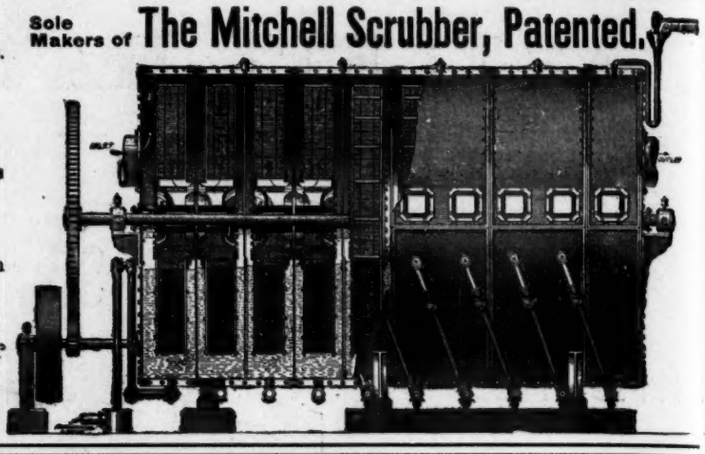

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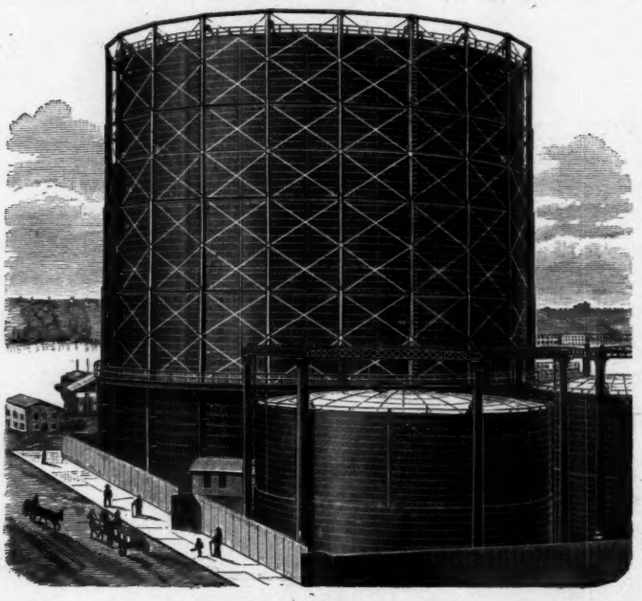

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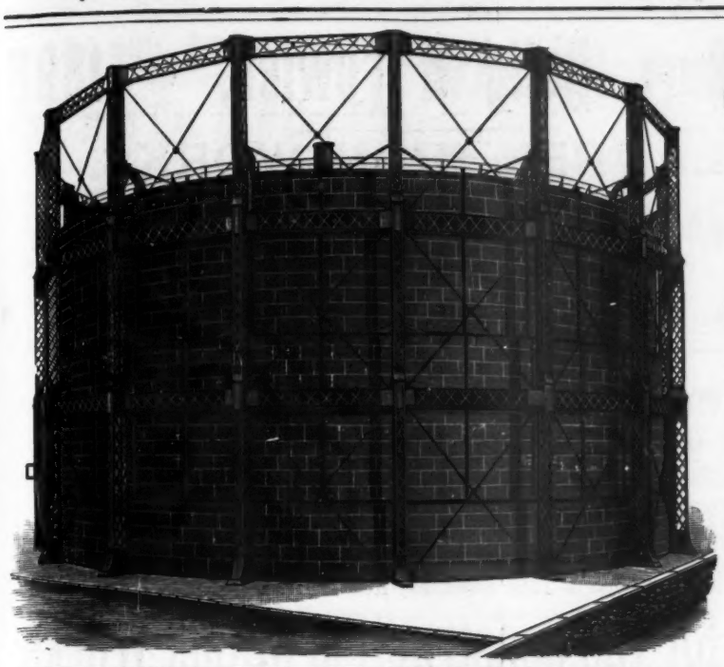

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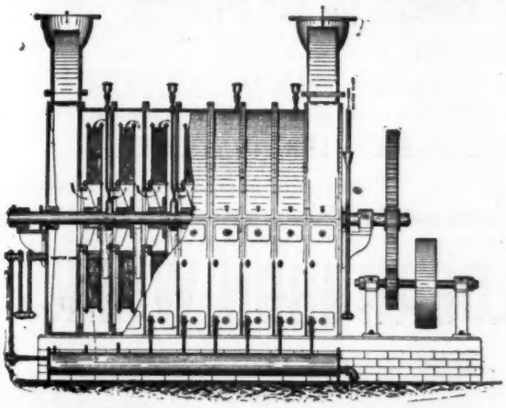

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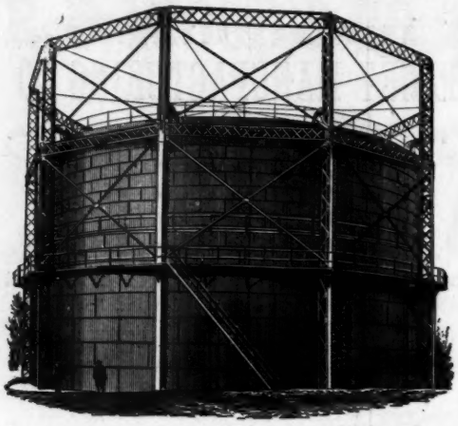

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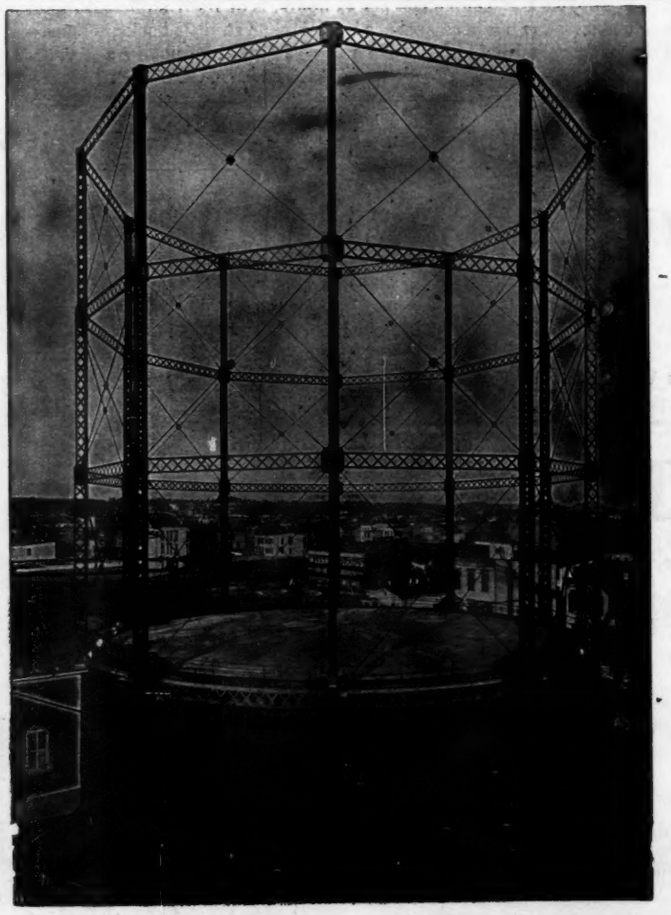

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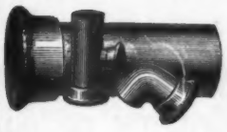

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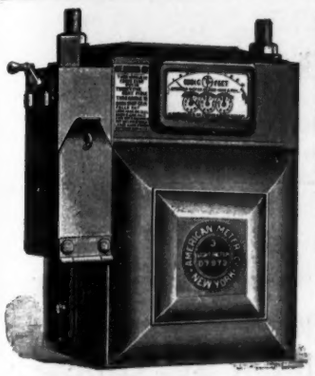

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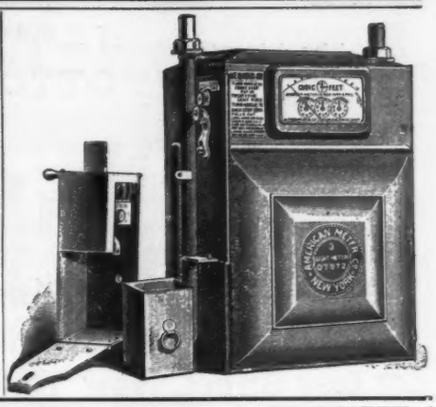

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